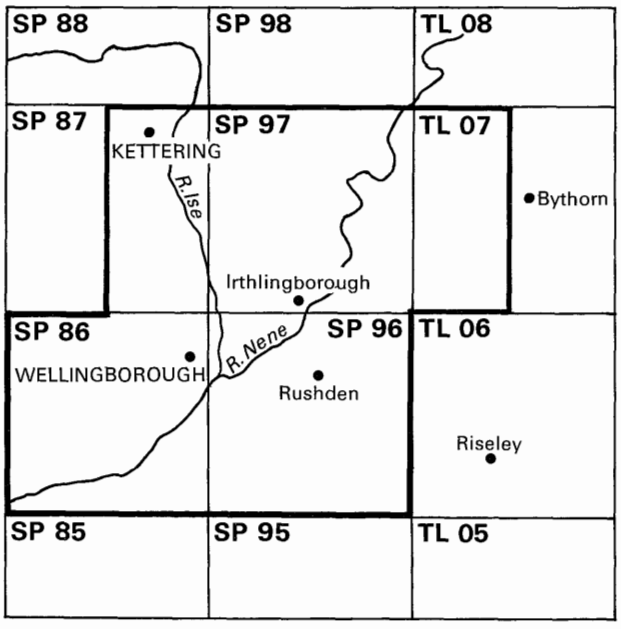
INSTITUTE OF GEOLOGICAL SCIENCES

Natural Environment Research Council

Mineral Assessment Report 114



The sand and gravel resources of the country around Kettering and Wellingborough, Northamptonshire

Description of 1:25 000 sheets SP97 and parts of SP87 and TL07; and SP86 and 96

A. M. Harrisson

ISBN 0 11 884314 1*

London Her Majesty's Stationery Office 1983

The first twelve reports on the assessment of British sand and gravel resources appeared in the Report Series of the Institute of Geological Sciences as a subseries. Report No. 13 and subsequent reports appear as Mineral Assessment Reports of the Institute.

Details of published reports appear at the end of this Report.

Any enquiries concerning this report may be addressed to Head, Industrial Minerals Assessment Unit,
Institute of Geological Sciences,
Keyworth, Nottingham NG12 5GG.

The asterisk on the front cover indicates that parts of sheets adjacent to the ones cited are described in this report.

PREFACE

National resources of many industrial minerals may seem so large that stocktaking appears unnecessary, but the demand for minerals and for land for all purposes is intensifying and it has become increasingly clear in recent years that regional assessments of the resources of these minerals should be undertaken. The publication of information about the quantity and quality of deposits over large areas is intended to provide a comprehensive factual background against which planning decisions can be made.

Sand and gravel, considered together as naturally occurring aggregate, was selected as the bulk mineral demanding the most urgent attention, initially in the south-east of England, where about half the national output is won and very few sources of alternative aggregates are available. Following a short feasibility project, initiated in 1966 by the Ministry of Land and Natural Resources, the Industrial Minerals Assessment Unit (formerly the Mineral Assessment Unit) began systematic surveys in 1968. The work is now being financed by the Department of the Environment and is being undertaken with the co-operation of the Sand and Gravel Association of Great Britain.

This report describes the sand and gravel resources of 400 km^2 of country around Kettering and Wellingborough, shown on the accompanying 1:25 000 resource maps. The survey was conducted during 1974-75 by A. H. Fawcett and A. M. Harrisson, who were assisted in the drilling and sampling programme by J. L. Knight, J. W. Merritt and W. R. J. Harries. Additional drilling, using a Minuteman power auger-rig, was carried out in 1978 by A. M. Harrisson and J. B. L. Wild. A. M. Harrisson compiled the report.

The area was first mapped (1864-1877) on the one-inch scale by J. W. Judd, H. H. Howell and W. H. Holloway and is included on the one-inch geological sheets Northampton (185), Wellingborough (186) and Kettering (171). It was remapped on the six-inch scale between 1939 and 1947 by J. H. Taylor, J. E. Prentice, P. A. Sabine, S. E. Hollingworth, F. A. Welch, V. Wilson, W. D. Evans, G. W. Green and A. W. Woodland.

Officers of the Property Services Agency based at Newmarket and J. W. Gardner CBE (IGS Land Agent) were responsible for negotiating access to land for drilling. The ready co-operation of landowners and tenants in this work is gratefully acknowledged.

G. M. Brown
Director

Institute of Geological Sciences
Exhibition Road
London SW7 2DE

6 August 1982.

CONTENTS

FIGURES

MAP

TABLES

The sand and gravel resources of the country around Kettering and Wellingborough, Northamptonshire

Description of 1:25 000 sheets SP 97 and parts of SP 87 and TL 07; and SP 86 and 96

A. M. Harrisson

SUMMARY

The geological maps of the Institute of Geological Sciences, pre-existing borehole information and 150 boreholes drilled for the Industrial Minerals Assessment Unit form the basis of the assessment of sand and gravel resources of the country around Kettering and Wellingborough, in parts of Northamptonshire, Cambridgeshire and Bedfordshire.

All the deposits in the area which might be potentially workable for sand and gravel have been investigated, and a simple statistical method has been used to estimate the volume. The reliability of the volume estimates is given at the symmetrical 95 per cent probability level.

The two 1:25 000 resources sheets are divided into four resource blocks containing between 5.4 and 19.2 km^2 of sand and gravel. For each block, the geology of the deposits is described and the mineral-bearing area, the mean thicknesses of overburden and mineral and the mean gradings are stated. Detailed borehole data are also given. The geology, the position of the boreholes and the outlines of the resource blocks are shown on the accompanying maps.

Notes

Each borehole registered with the Institute is identified by a four-element code (e.g. SP 86 SW 632). The first two elements define the 10-km square (of the National Grid) in which the borehole is situated; the third element defines a quadrant of that square, and the fourth is the accession number of the borehole.

All National Grid references in this publication lie within the 100-km square SP unless otherwise stated. Grid references are given to eight figures, accurate to within 10 m, for borehole locations. In the text, four-and six-figure grid references are used for more extensive locations, for example for farms.

Bibliographical reference

Harrisson, A. M. 1983. The sand and gravel resources of the country around Kettering and Wellingborough, in parts of Northamptonshire, Cambridgeshire and Bedfordshire: description of 1:25 000 sheets SP 97 and parts of SP 87 and TL 07 (Resource Sheet I) and SP 86 and 96 (Resource Sheet II).
Miner. Assess. Rep. Inst. Geol. Sci., No. 114.

Author

A. M. Harrisson, BSc
Institute of Geological Sciences
Knicker Hill, Keyworth
Nottingham NG12 5GG

INTRODUCTION

The survey is concerned with the estimation of resources, which include deposits that are not currently exploitable but have a foreseeable use, rather than reserves, which can only be assessed in the light of current, locally prevailing, economic considerations. Clearly, neither the economic nor the social factors used to decide whether a deposit may be workable in the future can be predicted; they are likely to change with time. Deposits not currently economically workable may be exploited as demand increases, as higher-grade or alternative materials become scarce, or as improved processing techniques are applied to them. The improved knowledge of the main physical properties of the resource and their variability, which this survey seeks to provide, will add significantly to the factual background against which planning policies can be decided (Archer, 1969; Thurrell, 1971, 1981; Harris and others, 1974).

The survey provides information at the 'indicated' and 'inferred' levels. 'Indicated' assessments "are computed partly from specific measurements, samples or production data and partly from projection for a reasonable distance on geologic evidence. The sites available for inspection, measurement, and sampling are too widely or otherwise inappropriately spaced to permit the mineral bodies to be outlined completely or the grade established throughout". 'Inferred' assessments are those "based largely on broad knowledge of the geologic character of the deposit and for which there are few, if any, samples or measurements." (Bureau of Mines and Geological Survey, 1948, p 15).

It follows that the whereabouts of reserves must still be established and their size and quality proved by the customary detailed exploration and evaluation undertaken by the industry. However, the information provided by this survey should assist in the selection of the best targets for such further work. The following arbitrary physical criteria have been adopted:

a The deposit should average at least 1 m in thickness.
b The ratio of overburden to sand and gravel should be no more than 3:1.
c The proportion of fines (particles passing a 0.625 mm B.S. sieve) should not exceed 40 per cent.
d The deposit should lie within 25 m of the surface, this being taken as the likely maximum working depth under most circumstances. It follows from the second criterion that boreholes are drilled no deeper than 18 m if no sand and gravel has been proved.

A deposit of sand and gravel that broadly meets these criteria is regarded as 'potentially workable' and is described and assessed as 'mineral' in this report.

Pre-Pleistocene rocks, which are usually consolidated and devoid of potentially workable sand and gravel, are referred to as 'bedrock'; 'waste' is any material other than bedrock or mineral; 'overburden' is waste that occurs between the surface and an underlying body of mineral.

For the particular needs of assessing sand and gravel resources, a grain-size classification based on the geometric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm, 64 mm has been adopted. The boundaries between fines (that is, the clay and silt fractions) and sand, and between sand and gravel grade material, are placed at $\frac{1}{16}$ mm and 4 mm respectively (see Appendix C).

The volume and other characteristics are assessed within resource blocks, each of which, ideally, contains

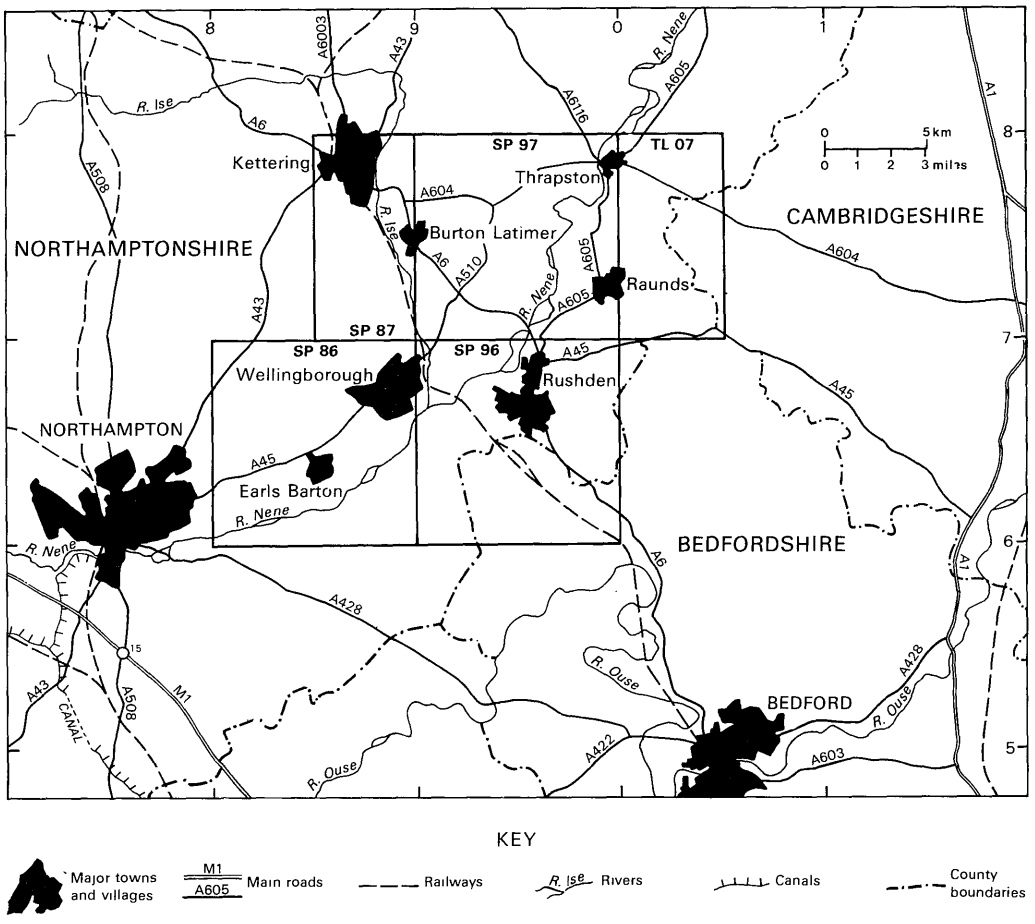


Figure 1 Map showing the location of the resource sheets with respect to the principal towns, the courses of the rivers Nene and Ise and the distribution of the major roads and railways within and near to the area assessed.

approximately 10 km^2 of sand and gravel. No account is taken of any factors, for example roads, villages or land of high agricultural or landscape value, which might stand in the way of sand and gravel being exploited, although towns are excluded. The estimated total volume therefore bears no simple relationship to the amount that could be extracted in practice.

It must be emphasised that the assessment applies to the resource block as a whole; valid conclusions cannot be drawn about mineral in parts of a block, except in the immediate vicinity of the actual sample points.

DESCRIPTION OF THE RESOURCE SHEET AREA

General

The resource sheets comprise an area of 400 km^2 situated north-east of Northampton (Figure 1) in the counties of Northamptonshire, Bedfordshire and Cambridgeshire. The area is almost equally divided by the River Nene which flows from Northampton [755 605] in the south-west to Thrapston [997 787] in the north-east. The principal towns are Kettering [867 784] in the north-west, Wellingborough [892 679], Higham Ferrers [926 685] and Rushden [995 725]. The area is well served by main roads trending both north-south and east-west but the only railway line within the area is that between Kettering and Bedford.

Topography

The area consists mainly of a plateau (Figure 2) between 200 and 400 ft (61-122 m) above OD that slopes gently eastwards. The plateau is bisected by the River Nene which flows north-eastwards towards the Wash, being joined at Wellingborough by the south-eastwards-flowing River Ise. In the south-west, the valley of the Nene is broad, but south of Wellingborough, it narrows and subsequently follows a winding course to Thrapston. The plateau is dissected by several tributaries of the main rivers.

Geology

The area is structurally simple with a regional dip of less than 0.5 degrees to the east. The southern boundary fault of the Stanton-Aldwincle trough cuts across the north-eastern corner of the area. Minor faults are common and are particularly evident where the Northampton Sand ironstone has been quarried. The predominant fault trend is east-south-east.

Superficial bulges and cambers are commonly associated with the main valleys.

SOLID

A number of Jurassic formations are present at outcrop. On the accompanying maps, these are included within the following five units, in ascending order: Lias, Inferior Oolite Group, Great Oolite Group, Cornbrash, and Oxford Clay. All are exposed along the valley sides, but are elsewhere concealed beneath drift. A deep borehole at Orton [7942 7916], west of Kettering, indicated that beneath the Jurassic and the underlying Triassic is an unconformity, the latter resting directly on rocks of probable Precambrian age.

Lias The oldest rocks proved by the survey were green chamositic oolites of the Marlstone Rock Bed (Middle Lias), encountered in assessment boreholes SP 86 SE 46 and 47. The overlying Upper Lias comprises fissile grey mudstones, 50-55 m thick, weathering to a stiff, bluish-grey silty clay which crops out along the valleys of the rivers Ise and Nene.

Inferior Oolite Group The Inferior Oolite Group in this area comprises the Northampton Sand and the Lower Estuarine 'Series'.

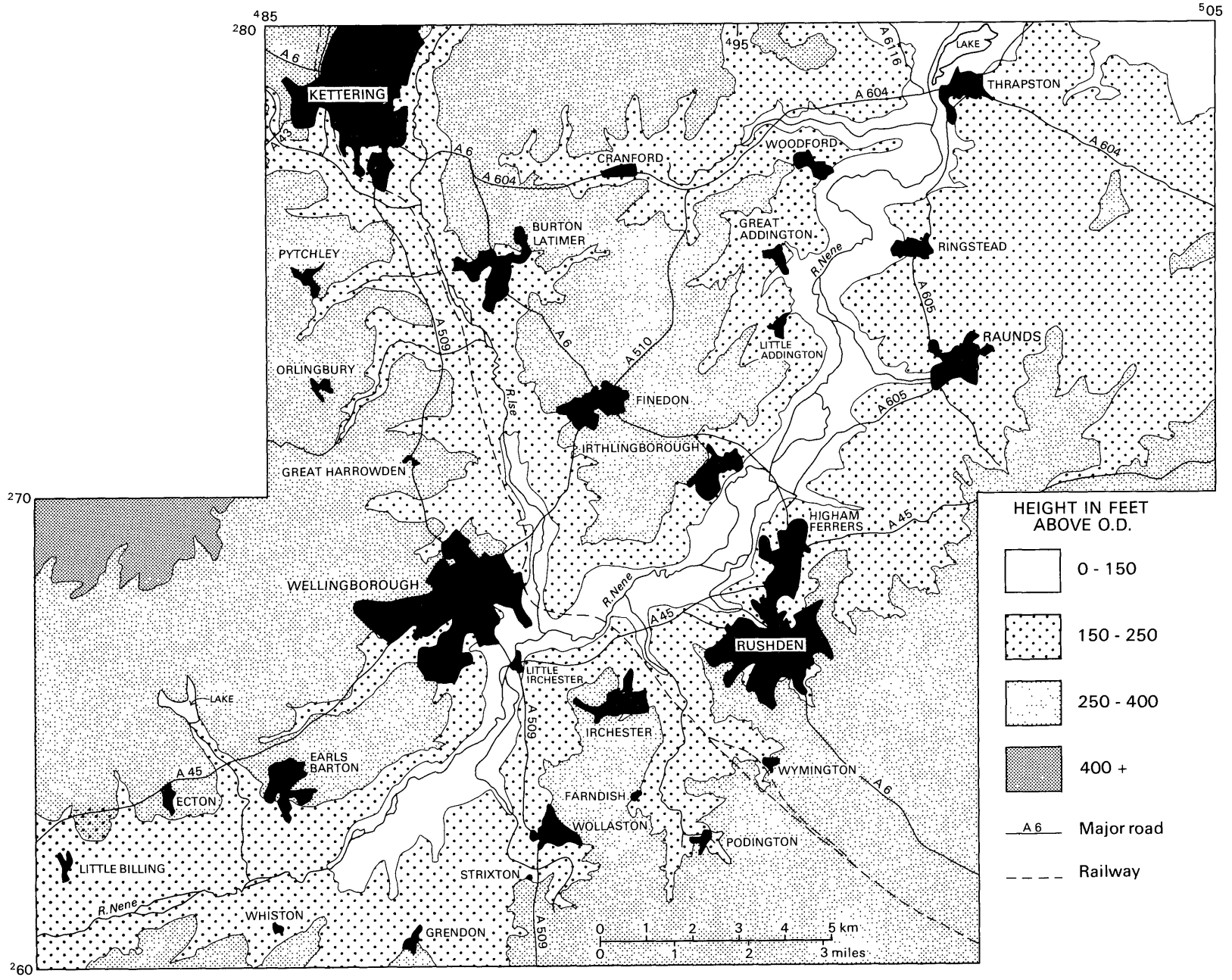


Figure 2 The general topography of the survey area, and the locations of towns and villages cited in the text.

The Northampton Sand, with a maximum thickness of about 7 m, consists of ironstones and sandstones which extend north-eastwards from Northampton. Between Thrapston, Wellingborough and Kettering the ironstone has been widely exploited.

The Northampton Sand is overlain by the Lower Estuarine 'Series' which locally oversteps the Northampton Sand to rest directly on the Upper Lias, for example near Great Harrowden [870 702] and Strixton [900 619]. The 'Series', which consists of frequently contorted fine sands, silts and mudstones, is generally less than 7 m thick, and in places thins out completely, for example at Farndish [927 633] and Whiston [850 603].

Great Oolite Group The Great Oolite Group is taken for the purposes of the present account to comprise the Upper Estuarine 'Series', the Blisworth Limestone and the Blisworth Clay.

The Upper Estuarine 'Series', up to 9 m thick, comprises three main divisions. The basal unit consists of freshwater silts and clays similar to those of the Lower Estuarine 'Series', together with a bed of nodular ironstone. The succeeding divisions comprise a thin limestone which passes up into a sequence of green and grey clays, silts and mudstones.

The Blisworth Limestone is a hard, massive limestone, 4.0 to 7.5 m thick, which forms a bench where it crops out along the valley sides, particularly between Higham Ferrers and Raunds [TL 000 731]. The overlying Blisworth Clay comprises grey, red, brown and green clays 3.5 to 6 m thick.

Table 1 Classification of deposits proved at the surface and in Industrial Minerals Assessment Unit boreholes.

		Thickness*
DRIFT		(m)
QUATERNARY		
Holocene and Pleistocene		
Alluvium		0.2-2.6
Alluvial Fans		up to 6.5
River Gravel:	First Terrace	0.7-5.4
	Second Terrace	2.5-4.5
Calcareous Tufa		up to 1.5
Head		1.0-3.0
Boulder Clay		1.0-12.0
Glacial Sand and Gravel		up to 10.0
SOLID		
JURASSIC		
Oxford Clay		
Kellaways Beds:	Sand	1.5-4.5
	Clay	0.5-3.1
Cornbrash		1.0-3.0
Great Oolite Group		
Blisworth Clay		3.5-6.0
Blisworth Limestone		4.0-7.5
Upper Estuarine 'Series'		up to 9.0
Inferior Oolite Group		
Lower Estuarine 'Series'		up to 7.0
Northampton Sand		up to 7.0
Lias		
Upper Lias		50-55
Marlstone Rock Bed (Middle Lias)		

* The thickness of Drift deposits are recorded measurements whereas those of the Solid deposits have been derived from published sources.

Cornbrash The Cornbrash, a reddish brown weathering, shelly and often flaggy limestone 1 to 3 m thick, is present in the eastern half of the area, where much of its outcrop is concealed by Boulder Clay. However, it is exposed along the valley sides of the Nene downstream from Higham Ferrers and Irthlingborough [947 706].

Oxford Clay (including the Kellaways Beds) The most westerly outcrops of these deposits are in the Great Addington [958 750], Little Addington [956 736] and Woodford [965 771] areas. Downstream of Higham Ferrers they form a plateau which covers the eastern part of the area.

The Kellaways Clay is a medium to dark grey mudstone 0.5 to 3.1 m thick. The overlying Kellaways Sand, 1.5 to 4.5 m thick, consists of intensely bioturbated greenish grey clayey silt and fine sand.

The Lower Oxford Clay consists of mudstone which weathers to a bluish grey or greenish grey clay with selenite crystals; there is an abundant molluscan fauna. The Middle and Upper Oxford Clay are absent in this area.

DRIFT

The drifts of this and neighbouring areas comprise an older glacial sequence and younger, predominantly fluviatile deposits. The glacial sequence, except possibly for minor local deposits, resulted from a single glacial epoch during which ice advanced from the north-east. On retreat, the ice left behind a thick cover of till and associated sands and gravels. Modern drainage was established on this surface and fluviatile sedimentation, which produced the river gravels and alluvium, continues to the present day.

Glacial Sand and Gravel The oldest drift deposits known in the area were recognised in a section 2 miles (3.2 km) south of Irchester [925 658], which exposed a gravel of locally-derived limestone and ironstone underlying Boulder Clay (the Lower Boulder Clay of Hollingworth and Taylor, 1946). A sand of similar lithology was found beneath Lower Boulder Clay in borehole SP 97 NE 151.

Sands and gravels comprising predominantly angular fragments of flint, limestone, ironstone, quartzite and rare chalk occur beneath, within and above the Chalky Boulder Clay (see below), for example in boreholes SP 96 SW 51, SW 53 and SW 59, respectively. They were probably deposited as outwash from the ice sheet in its various stages of advance and retreat.

Boulder Clay Two boulder clay lithologies have been described in the area (Taylor, 1963), the Lower Boulder Clay and the Chalky Boulder Clay. The former is a stiff, dark grey to greenish grey clay with an abundance of gritty, quartzose material, fragments of Jurassic limestone and ironstone, and quartzite pebbles, probably derived from the Sherwood Sandstone Group. Its outcrop is restricted to the margins of the Chalky Boulder Clay in the vicinity of Pytchley [903 750], Orlingbury [860 722], Great Addington, Woodford, Strixton, Podington [942 626] and Wymington [955 644]. Only one assessment borehole (SP 97 NE 151) penetrated the Lower Boulder Clay (described as 'Boulder Clay' in the borehole log), and no boreholes sited on Chalky Boulder Clay proved Lower Boulder Clay at depth. However, a local occurrence of Chalky Boulder Clay directly overlying Lower Boulder Clay was recorded (Taylor, 1963, p.17) at Brigstock [955 849] to the north of the survey area.

Chalky Boulder Clay includes a complex and highly variable sequence of till, gravels and silts. The brown

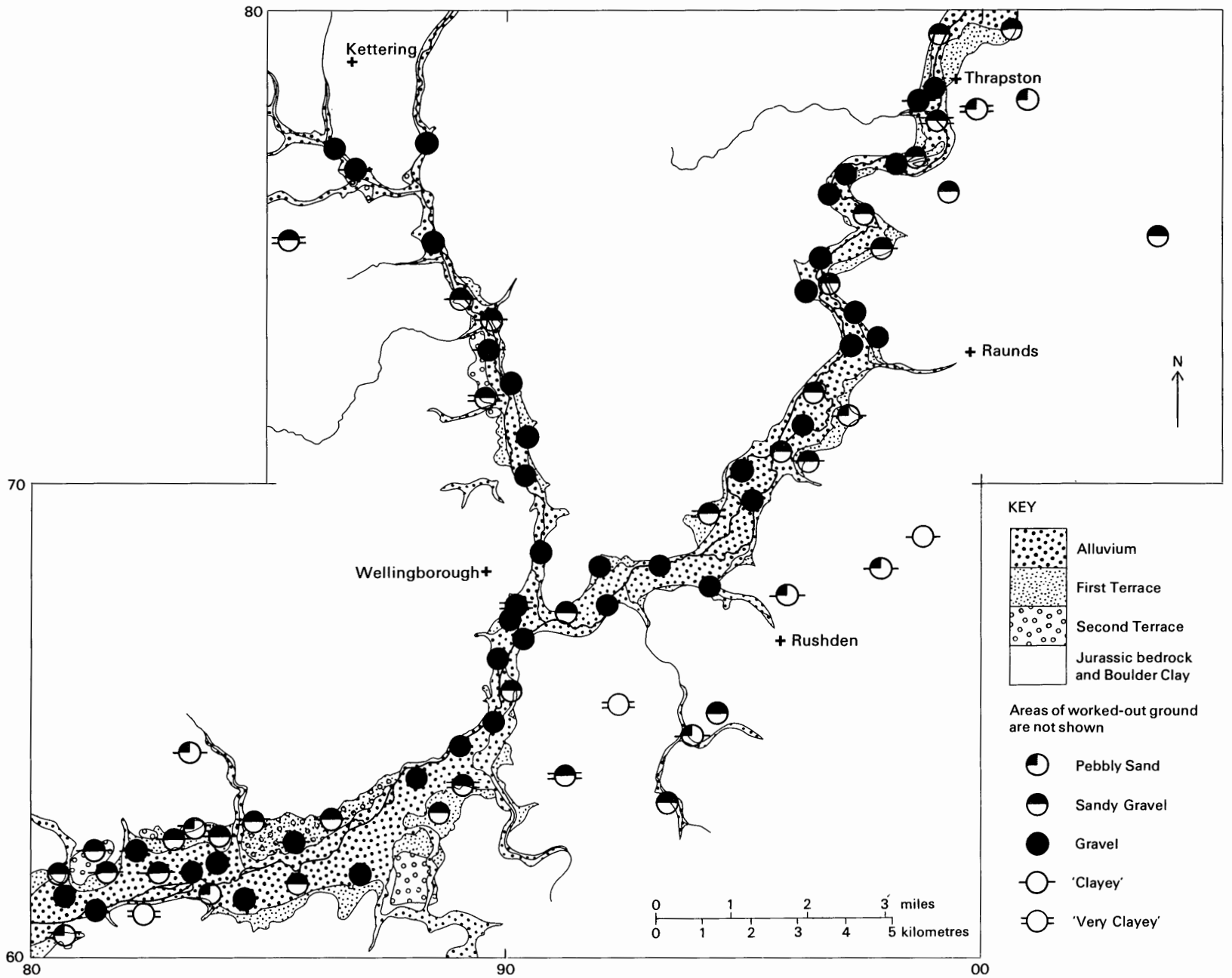


Figure 3 Pebble type analyses of fine gravel (+4-16 mm) samples from selected IMAU boreholes.

and grey till is characterised by chalk pebbles and comminuted chalk 'flour', with flint, ironstone, limestone, and quartzite as other common erratics. Chalky Boulder Clay probably originally covered the whole area, but has been largely eroded from the main valleys, and is now generally confined to the broad interfluves.

The valley of the River Nene at Northampton is underlain by a deep depression in the sub-drift floor, filled with deposits of Chalky Boulder Clay age, comprising till and a thick sequence of laminated silts and clays.

Head Consisting of pebbly sandy clay, head occurs throughout the area but only the more extensive patches are shown on the map, for example east of Strixton, at [913 617].

Calcareous Tufa Spreads of calcareous tufa, a hard limestone precipitate, occur at several localities, notably at Coppicemoore Spinney [862 760] and north of Wollaston at [910 645].

River Gravels The valleys of the rivers Ise and Nene contain remnants of two gravel terraces, the Second and First terraces.

Second Terrace deposits, 2.5-4.5 m thick, crop out sporadically on the the flanks of the valley of the Nene in the south of the area, notably at Little Billing [805 619] and north of Grendon [879 604], and as smaller scattered patches along the valley of the Ise. A feature south of Earls Barton [852 638] mapped as First/Second Terrace is at a height (ie. 7 to 15 m above the river) consistent with that of the Second Terrace in this area. The gravels consist predominantly of ironstone, flint and limestone in varying proportions, with subsidiary quartzite and quartz. The proportions of the main constituents are governed chiefly by the nature of the surrounding bedrock, or, in the case of flint, the proximity of Boulder Clay.

First Terrace deposits crop out at 1 to 3 m above the rivers Nene and Ise as discontinuous exposures along both sides of the valleys, and as spreads beneath alluvium. The gravels are similar in composition to those of the Second Terrace.

Alluvium and Alluvial Fans Alluvium overlies First Terrace gravels or bedrock. It consists of clay and silt with scattered pebbles, and generally a basal bed of gravel is present. The alluvial fans are more gravelly, and slope gently down to the floodplain, with which they gradually merge.

Composition of the Sand and Gravel Deposits

The potentially workable sand and gravel comprises Glacial Sand and Gravel and River Gravel in the terrace deposits of the rivers Nene and Ise. Samples of +4-16 mm material from selected boreholes (amounting to 11 per cent of those drilled) were examined to determine their lithologies (Table 2 and Figure 3).

Glacial Sand and Gravel This deposit occurs in isolated patches in resource block D (for a definition of a resource block, see Appendix A). The mean particle size distribution of samples from 15 IMAU boreholes proving this deposit to be 'mineral' are shown in Table 7 and Figure 8. Whereas the fines content of the samples demonstrates a considerable range (3 to 40 per cent), all are alike in having a higher proportion of sand than gravel, the sand being predominantly of medium grade. The gravel fraction usually exceeds 15 per cent but is always less than 30 per cent and fine-grained. The gravel consists of ironstone and limestone with flint and quartzite, whereas the sand fraction comprises mainly quartz and ironstone.

The mineral classification ranges evenly from pebbly sand to 'very clayey' sandy gravel, and the mean grading for the deposit as a whole is fines 14 per cent, sand 65 per cent and gravel 21 per cent.

River Gravel The grain-size distribution in this deposit, arranged by resource blocks and calculated from 40 IMAU boreholes, is given in Tables 4 and 5 and Figures 5 and 6. In the First Terrace deposits, the gravel fraction (composed predominantly of fine-grade material) commonly exceeds the total percentage of sand - comprising mainly medium and coarse grades. The fines content as a whole is generally low, exceeding 20 per cent in only six boreholes. Thus, the deposit is classified as a gravel.

The grading characteristics of Second Terrace deposits in block B (Tables 4 and 5 and Figures 5 and 6) show that the grading extremes are similar to those for the First Terrace deposits but in block A, the proportion of sand (based on fewer data) is more. The gravel fraction consists mainly of ironstone, limestone and flint in varying proportions, with subsidiary amounts of quartz and quartzite (Table 2; Figure 3).

Table 2 Composition of fine gravel (+4 -16 mm) samples from selected boreholes.

Borehole	Percentage by weight						
	Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Other
86 SW 643	79	13	trace	trace	8	0	trace
86 SE 50	52	30	6	0	12	0	0
86 SE 55	55	24	15	trace	6	trace	trace
87 SE 5	51	42	2	trace	5	0	0
96 NW 152	50	17	29	trace	4	0	trace
96 NW 154	34	41	14	5	6	0	trace
96 NW 158	52	30	4	5	9	0	trace
96 NW 164	31	15	53	trace	1	trace	trace
96 NE 1	31	33	21	1	14	0	trace
96 SW 48	39	30	27	trace	4	0	trace
97 NE 157	40	26	32	trace	2	trace	trace
97 NE 158	53	24	20	trace	3	trace	trace
97 NE 159	31	30	31	trace	3	0	5
97 SE 106	38	19	37	trace	6	trace	trace
97 SE 115	37	23	37	trace	1.5	trace	1.5
07 NW 36	67	20	11	0	2	0	trace
07 NW 39	50	2	48	0	0	0	trace

Table 3 Summary of results: the sand and gravel resources of the area assessed.

Block	Area		Mean thickness		Volume of mineral			Mean grading percentages		
	Block	Mineral	Overburden	Mineral		Limits at the 95% confidence level		Fines	Sand	Gravel
	km^2	km^2	m	m	Million m^3	±%	±Million m^3	$-\frac{1}{16}$ mm	$+\frac{1}{16}$–4 mm	+4 mm
a	**Assessment of blocks A to C at the indicated level**									
A(30)*	21.5	19.2	1.7	2.3	44.2	13	5.7	10	43	47
B(11)	6.3	5.4	1.4	2.3	12.4	29	3.6	10	42	48
C(29)	15.7	13.4	1.9	2.9	38.9	14	5.4	6	49	45
A to C (70)	**43.5**	**38.0**	**1.7**	**2.5**	**95.0**	**10**	**9.5**	**9**	**45**	**46**
b	**Assessment of block D at the inferred level**									
D(15)	156.5	3.0	2.8	3.2	9.6	-	-	14	65	21

* Figures in brackets show the number of samples points used in the assessment of the volume

The proportions of each constituent are largely dependent on the nature of the local geology. For example, in borehole SP 86 SW 643, with only Inferior Oolite and Lias Clay in close proximity, the mineral contains 79 per cent of ironstone pebbles and 21 per cent of flint and quartzite derived from the Boulder Clay. Farther downstream, where the River Nene flows across the higher beds of the Middle Jurassic, limestone becomes a more important constituent (see Figure 3). The presence of flint in every borehole indicates the influence of Boulder Clay on the lithology of the River Gravel.

The Maps

The sand and gravel resource maps (Sheets I and II) are folded into the pocket at the end of this report. The base maps are the Ordnance Survey 1:25 000 Outline Editions in grey, on which the geological data are shown in black and the mineral resource information in shades of red.

Geological data The geological boundary lines are taken from the Northampton (185), Wellingborough (186) and Kettering (171) sheets, surveyed between 1939 and 1947 at the scale of 1:10 560. Borehole data, which include the stratigraphical relations and mean particle size distribution of sand and gravel samples collected during the assessment survey, are also shown.

The geological boundaries are regarded as the best interpretation of the information available at the time of the survey. However, it is inevitable that local irregularities or discrepancies will be revealed by some boreholes. These are taken into account in the assessment of resources (see below).

Mineral resource information The mineral-bearing ground is divided into resource blocks (see Appendix A). Within a resource block the mineral is subdivided into areas where it is exposed, that is where the overburden averages less than 1 m in thickness, and areas where it is present in continuous, or almost continuous, spreads beneath overburden. The recognition of these categories is dependent upon the importance attached to the proportion of boreholes which did not find potentially workable sand and gravel and the distribution of barren boreholes within a block. The mineral is described as 'almost continuous' if it is present in 75 per cent or more of the boreholes in a resource block.

Areas where bedrock crops out, where boreholes indicate an absence of sand and gravel beneath cover and where sand and gravel beneath cover is interpreted to be not potentially workable, are left uncoloured on the maps; where appropriate, the relevant criterion is noted. In such cases it has been assumed that mineral is absent except in infrequent and relatively minor patches that can neither be outlined nor assessed quantitatively in the context of this survey. Areas of unassessed sand and gravel, for example in built-up areas, are indicated by a red stipple.

The area of the mineral-bearing ground is measured, where possible, from the mapped geological boundary lines. The whole of this area is considered as mineral-bearing, even though it may include small areas where sand and gravel is not present or is not potentially workable. Inferred boundaries have been inserted to delimit areas where sand and gravel beneath cover is interpreted to be not potentially workable or absent. Such boundaries (for which a distinctive zig-zag symbol is used) are drawn primarily for the purpose of volume estimation. The symbol is intended to indicate an approximate location within a likely zone of occurrence rather than to represent the breadth of the zone, its size being determined only by cartographical considerations. For the purpose of measuring areas the centre line of the symbol is used.

Results

The statistical results are summarised in Table 3. Fuller grading particulars are shown in Figures 4 to 9 and Tables 4 to 7 inclusive.

Accuracy of results For the resource blocks assessed at the indicated level, the accuracy of the results at the 95 per cent probability level (that is, on average nineteen out of every twenty sets of limits constructed in this way contain the true value for the volume of mineral) varies between 14 per cent and 51 per cent. However, the true volumes are more likely to be nearer the figure estimated than either of the limits. Moreover, it is probable that roughly the same percentage limits would apply for the statistical estimate of mineral volume within a very much smaller parcel of ground (say 100 hectares) containing similar sand and gravel deposits, if the results from the same number of sample points (as provided by, say, ten boreholes) were used in the calculation. Thus, if closer limits are needed for a quotation of reserves, data from more sample points would be required, even if the area were quite small. This point can be illustrated by considering the whole of the potentially workable sand and gravel in Blocks A to C. The total volume (95 million m^3) can be estimated to limits of ± 10 per cent at the 95 per cent

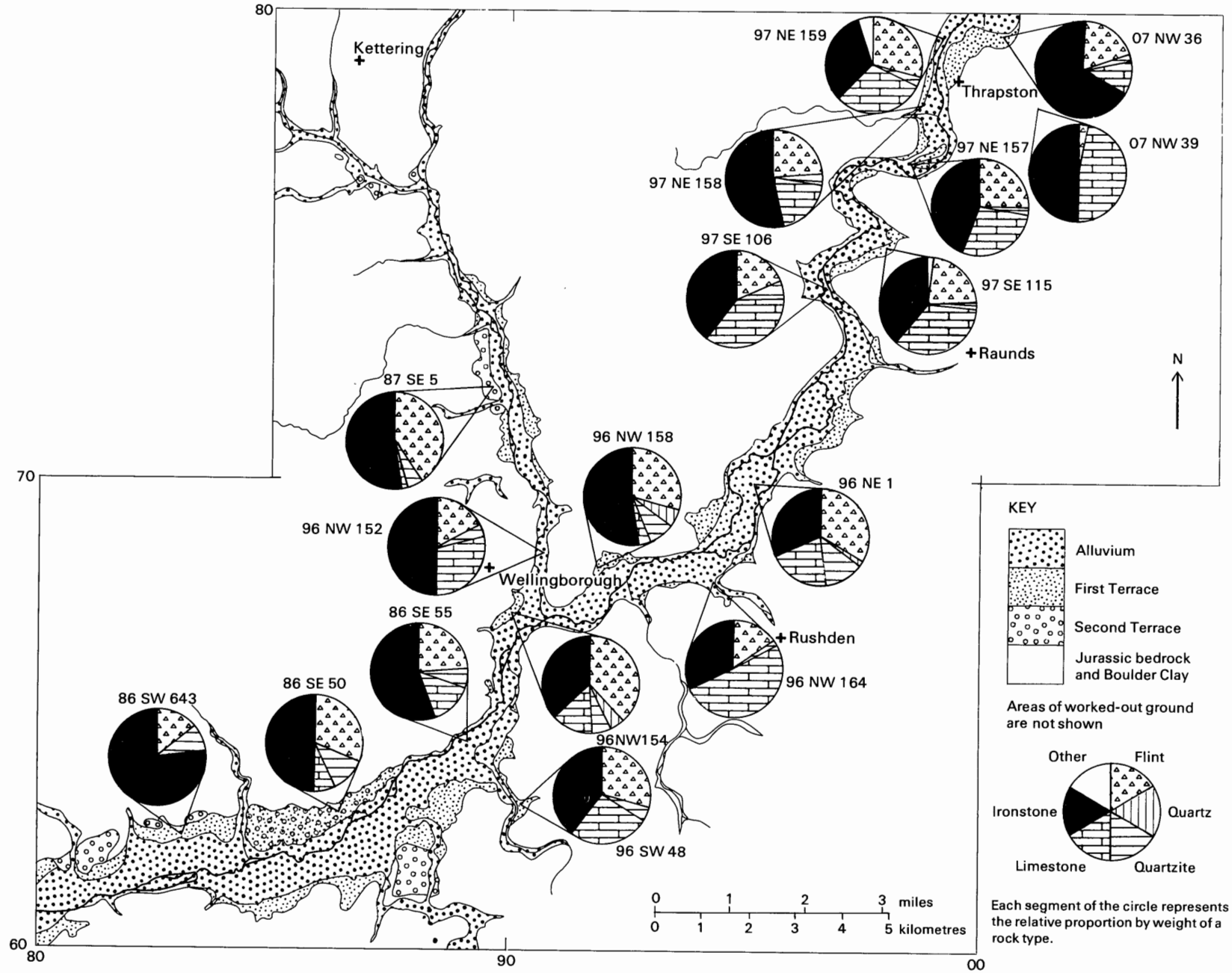


Figure 4 The grading characteristics of samples from IMAU boreholes.

Table 4 Block A: data from IMAU boreholes proving mineral.

Borehole number	Recorded thickness		Mean grading percentage						
	Over-burden	Mineral	Fines	Sand			Gravel		Grading Classification
				Fine	Medium	Coarse	Fine	Coarse	
	m	m	$-\frac{1}{16}$ mm	$+\frac{1}{16}-\frac{1}{4}$ mm	$+\frac{1}{4}$ -1 mm	+1 -4 mm	+4 -16 mm	+16 mm	
First Terrace									
86 NE 78	1.5	2.8	1	2	15	19	36	27	G
86 SW 632	1.9	2.4	7	7	25	15	33	13	SG
86 SW 633	3.0	1.0+	1	0	9	21	43	26	G
86 SW 634	0.8	0.7	23	22	27	11	14	3	VC PS
86 SW 636	1.0	2.5	10	7	25	16	28	14	C SG
86 SW 637	3.3	2.2	1	0	5	12	37	45	G
86 SW 639	1.7	3.5+	12	9	22	11	26	20	C G
86 SW 640	1.4	2.2	14	12	28	14	20	12	C SG
86 SW 643	0.9	1.2	30	10	19	11	19	11	VC SG
86 SW "	1.0	1.5	3	3	19	16	31	28	G
86 SW 644	1.9	1.2	12	9	17	19	29	14	C SG
86 SW 645	1.3	2.3	6	5	23	16	31	19	G
86 SW 646	1.2	3.9	9	3	18	21	33	16	G
86 SW 647	2.0	2.0+	7	15	48	10	15	5	PS
86 SW 649	2.1	1.8	2	2	12	14	36	34	G
86 SE 46	6.2	2.0	19	7	11	11	13	39	CG
86 SE 47	2.1	4.0	10	5	20	20	28	17	SG
86 SE 50	2.1	2.3	12	5	24	16	28	15	C SG
86 SE 51	2.5	2.4	6	5	16	19	32	22	G
86 SE 55	1.9	2.1	3	3	19	21	41	13	G
86 SE 56	1.7	2.5	5	3	26	17	27	22	G
86 SE 57	0.7	2.1	7	12	22	12	29	18	SG
86 SE 58	1.4	3.0+	1	4	16	18	41	20	G
86 SE 60	0.4	1.8	22	13	20	12	20	13	VC SG
96 NW 153	2.2	1.2	22	4	13	8	27	26	VC G
96 NW 154	1.0	3.7	8	6	19	18	35	14	G
96 NW 155	1.7	2.4	1	6	24	17	29	23	G
96 NW 156	1.2	2.7	3	5	35	14	29	14	SG
Mean	**1.8**	**2.3**	**8**	**6**	**21**	**16**	**30**	**19**	**G**
Second Terrace									
86 SW 635	0.5	2.0	15	10	30	14	25	6	C SG
86 SW 642	0.3	2.5	33	25	19	7	12	4	VC PS
86 SW 648	0.8	2.0	21	15	16	12	26	10	VC SG
Mean	**0.5**	**2.2**	**24**	**17**	**21**	**11**	**20**	**7**	**VC SG**
Overall Mean	**1.7**	**2.3**	**10**	**7**	**21**	**15**	**29**	**18**	**C G**

\+ indicates that the base of the deposit was not reached.

Key to abbreviations

C 'Clayey' G Gravel S Sand/sandy VC 'Very clayey' P Pebbly

probability level by a calculation based on the data from the 72 sample points spread across the three resource blocks. However, it must be emphasised that the quoted volume of mineral has no simple relationship with the amount that could be extracted in practice, as no allowance has been made in the calculations for any restraints (such as existing buildings and roads) on the use of the land for mineral working.

Notes on the Resource Blocks

Only 10.5 per cent (42.6 km^2) of the survey area has been assessed as mineral-bearing, the deposits occurring in the valleys of the rivers Nene and Ise. Discontinuous spreads of glacial deposits, situated mainly east of the Nene, have not been assessed because of their variability. Sand and gravel extraction has taken place at several localities along the Nene valley and in addition, much of the district has been exploited for ironstone.

The mineral-bearing area is divided into four resource blocks, each designated by a letter, and the block boundaries are drawn using geological criteria. Thus blocks A and C include all the First and Second Terrace deposits of the Nene valley while block B incorporates the fluvial deposits of the Ise valley. Block D contains all the deposits of Glacial Sand and Gravel and those areas between the two river valleys where the sand and gravel is probably not potentially workable because it is too thin or patchily distributed beneath overburden.

Block A

Block A occupies an area of 21.5 km^2 in the Nene valley between Northampton and Wellingborough. Apart from 2.3 km^2 of worked-out ground, the entire block is mineral-bearing and contains First and Second Terrace River Gravel, overlain by Alluvium on the floodplain. Most of the Nene's tributaries have been excluded from the assessment because boreholes show them to contain

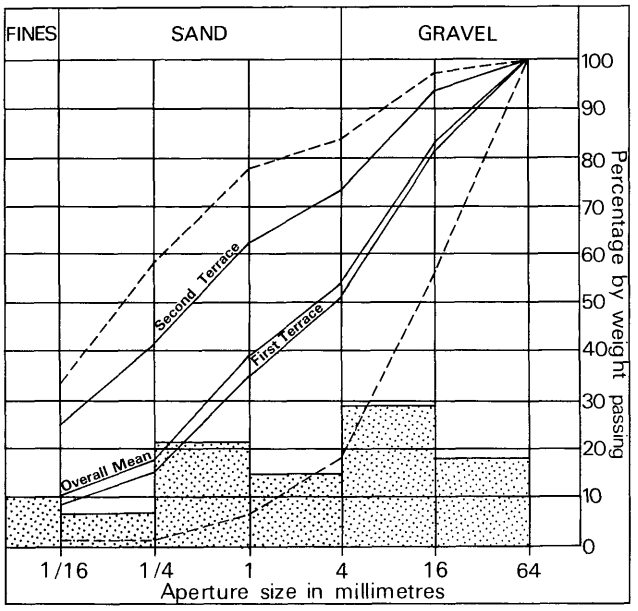


Figure 5 Grading characteristics of the resources within Block A (based on 31 boreholes). The continuous lines represent the weighted mean grading curves for the Drift deposits and the Block as indicated; the broken lines denote the envelope containing the mean grading curves based on individual boreholes. The mean grading of the block is also shown as a histogram.

no mineral deposits (for definition of 'mineral', see Introduction).

The assessment is based on information from 34 IMAU boreholes. All but three (SP 86 SW 650, SP 86 SE 49 and SP 86 SE 52) proved mineral ranging in thickness from 0.7 to 4.0 m; the mean thickness is 2.3 m. The estimated volume is 44.2 million m^3 $\pm$ 17 per cent. The overburden has a mean thickness of 1.7 m.

The mean grading of mineral is fines 10 per cent, sand 43 per cent and gravel 47 per cent (see Tables 3 and 4). The gravel contains a significantly high proportion of ironstone (79 per cent in borehole SP 86 SW 643) that decreases downstream (Table 2 and Figure 3) as the other main constituents, particularly limestone, increase.

First Terrace sand and gravel has been worked extensively near Little Billing and South of Earls Barton, while Second Terrace deposits have been worked north of Grendon (see Resource Sheet II).

Block B

This block is 6.3 km^2 in area and occupies the valley of the River Ise between Wellingborough and Kettering; 5.4 km^2 are mineral-bearing and consist of First and Second Terrace River Gravel, overlain by Alluvium on the floodplain. Upstream from where the Ise bifurcates (ie south of Kettering), the sub-alluvial gravels are considered to be Second Terrace. On the basis of five IMAU boreholes, tributary valleys of the Ise have been excluded from this block. Only one borehole (SP 87 NE 83) sited in the valley of the River Ise failed to prove mineral.

The assessment is based on information from 17 IMAU boreholes. Mineral, proved in 11 boreholes, ranged in thickness between 1.1 and 4.0 m with a mean of 2.3 m. The estimated volume is 12.4 million m^3 $\pm$29 per cent. The mean thickness of overburden is 1.4 m.

The mean grading of mineral is fines 10 per cent, sand 42 per cent and gravel 48 per cent (see Table 5). South from Kettering to near Finedon [912 719], the gravel consists mainly of ironstone, derived from out-

Table 5 Block B: data from IMAU boreholes proving mineral.

Borehole number	Recorded thickness		Mean grading percentage						
	Over-burden	Mineral	Fines	Sand			Gravel		Grading Classification
	m	m	$-\frac{1}{16}$ mm	Fine $+\frac{1}{16}-\frac{1}{4}$ mm	Medium $+\frac{1}{4}$ -1 mm	Coarse +1 -4 mm	Fine +4 -16 mm	Coarse +16 mm	
First Terrace									
87 NE 84	2.3	1.2	3	3	8	19	27	40	G
87 SE 3	0.3	3.3	17	15	19	16	24	9	C SG
87 SE 4	0.9	3.2	14	7	15	20	23	21	C G
87 SE 6	1.3	1.8	4	3	8	18	37	30	G
96 NW 152	1.2	3.6	1	3	15	23	36	22	G
97 SW 274	0.7	2.1	5	6	15	23	32	19	G
97 SW 275	1.6	1.9	2	3	19	24	34	18	G
Mean	**1.2**	**2.4**	**7**	**6**	**14**	**20**	**30**	**23**	**G**
Second Terrace									
87 NE 77	2.4	1.1	8	5	9	28	37	13	VC SG
87 NE 78	1.6	2.5	19	10	15	15	25	16	C G
87 NE 82	2.7	1.6	1	2	16	24	42	15	G
87 SE 5	0.5	4.0	25	17	16	12	17	13	VC SG
Mean	**1.8**	**2.3**	**13**	**9**	**14**	**20**	**30**	**14**	**CG**
Overall Mean	**1.4**	**2.3**	**10**	**8**	**14**	**20**	**30**	**18**	**CG**

Key to abbreviations

C 'Clayey' G Gravel S Sand/sandy VC 'Very clayey' P Pebbly

Table 6 Block C: data from IMAU boreholes proving mineral.

Borehole number	Recorded thickness		Mean grading percentage						
	Over-burden	Mineral	Fines	Sand			Gravel		Grading Classification
				Fine	Medium	Coarse	Fine	Coarse	
	m	m	$-\frac{1}{16}$ mm	$+\frac{1}{16}-\frac{1}{4}$ mm	$+\frac{1}{4}$ -1 mm	+1 -4 mm	+4 -16 mm	+16 mm	
96 NW 157	2.8	2.2	3	4	19	27	32	15	SG
96 NW 158	3.7	2.8	4	2	6	16	52	20	G
96 NW 159	3.0	3.0+	4	2	17	28	40	9	G
96 NW 160	2.0	2.1	1	2	10	17	46	24	G
96 NW 163	2.6	1.5	28	20	14	13	15	10	VC SG
96 NW 164	4.0	4.0	5	6	18	19	26	26	G
96 NE 1	1.3	2.6	5	3	16	22	30	24	G
97 NE 153	1.4	2.2	2	5	22	20	35	16	G
97 NE 154	0.9	2.2	6	4	20	21	33	16	G
97 NE 155	0.4	4.0+	9	6	27	20	31	7	SG
97 NE 157	0.8	1.6	14	14	14	10	22	26	CG
97 NE 158	1.5	4.3	8	5	16	17	33	21	G
97 NE 159	1.1	4.9	3	10	51	11	20	5	SG
97 NE 160	4.1	3.0	3	1	16	24	42	14	G
97 NE 161	2.1	1.9	23	15	29	12	20	1	VC SG
97 NE 162	1.0	2.9	8	6	26	22	29	9	SG
97 SE 103	0.9	3.6	7	9	25	16	34	9	SG
97 SE 104	1.4	2.4	5	4	18	26	33	14	G
97 SE 105	2.7	3.8	2	3	10	18	46	21	G
97 SE 106	2.0	1.9	3	3	19	30	38	7	SG
97 SE 107	1.4	3.0	3	5	37	22	30	3	SG
97 SE 108	1.3	4.3	3	2	17	23	44	11	G
97 SE 109	1.2	1.0	26	35	27	4	4	4	VC PS
97 SE "	2.7	1.6	7	6	20	14	46	7	G
97 SE 111	2.6	2.2	1	1	16	17	48	17	G
97 SE 112	3.5	1.4	4	1	11	16	39	29	G
97 SE 113	1.8	3.3	3	2	16	22	43	14	G
97 SE 114	0.2	5.0	10	20	36	13	17	4	C PS
97 SE 115	0.9	4.5+	12	16	28	12	22	10	C SG
07 NW 36	2.3	3.7	7	13	19	13	24	24	SG
Mean	**1.9**	**2.9**	**6**	**8**	**22**	**19**	**32**	**13**	**SG**

\+ indicates that the base of the deposit was not reached

Key to abbreviations

C 'Clayey' G Gravel S Sand/sandy VC 'Very clayey' P Pebbly

crops of the Northampton Sand within the river valley, and flint, derived from the Boulder Clay (Figure 3). However, near the Ise's confluence with the River Nene, the former flows over the higher Jurassic rocks and there is a higher proportion of limestone clasts in the River Gravel.

Block C

Block C is 15.7 km^2 in area and includes the valley of the River Nene from its confluence with the Ise downstream to Thrapston and the limit of Sheet I. On the basis of four IMAU boreholes, four tributaries of the Nene have been excluded from this block, but elsewhere 13.4 km^2 are mineral-bearing and consist of First Terrace River Gravel overlain by Alluvium on the floodplain.

The assessment is based on information from 30 IMAU boreholes, of which 29 proved mineral. The mineral ranged in thickness from 1.0 to 5.0 m thick with a mean of 2.9 m. The estimated volume is 38.9 million m^3 $\pm$ 14 per cent. The mean thickness of overburden is 1.9 m.

The mean grading of the mineral is fines 6 per cent, sand 49 per cent and gravel 45 per cent (see Fig. 7 and Table 6). In the gravels, the principal constituents are ironstone and limestone that vary proportionately according to the bedrock in the immediate vicinity. Flint is the other major rock type, with some quartzite and quartz.

Block D

Block D, which is 156.5 km^2 in area and the largest of four resource blocks, contains the least amount of mineral, which comprises isolated patches of Glacial Sand and Gravel or discontinuous spreads beneath Boulder Clay. On the basis of the distribution of the Glacial Sand and Gravel, the block is broadly divisible into three parts.

In the western part, only two significant patches were found. At Pytchley, borehole SP 87 NE 76 proved Glacial Sand and Gravel to extend beneath Boulder Clay while north of Ecton [828 635], an area mapped as Glacial Sand and Gravel proved to be of mineral grade. Three other IMAU boreholes in this area failed to prove mineral.

Between the rivers Ise and Nene, the area has been widely investigated for ironstone, and hence only three IMAU boreholes were drilled near Great Addington [958 751]. Because of the overburden to sand and gravel ratio in these boreholes (see Introduction), no mineral was proved.

East and south-east of the River Nene, several patches of Glacial Sand and Gravel on the edge of the Boulder Clay outcrop were investigated by drilling 28 shell and auger and three Minuteman power-auger holes. All the boreholes demonstrated that any Glacial Sand and Gravel, other than that 'exposed', occurred in patches beneath overburden and probably was not potentially workable.

Table 7 Block D: data from IMAU boreholes proving mineral.

Borehole number	Recorded thickness		Mean grading percentage						
	Over-burden	Mineral	Fines	Sand			Gravel		Grading Classification
	m	m	$-\frac{1}{16}$ mm	Fine $+\frac{1}{16}-\frac{1}{4}$ mm	Medium $+\frac{1}{4}$ -1 mm	Coarse +1 -4 mm	Fine +4 -16 mm	Coarse +16 mm	
86 SW 638	2.1	2.2	15	33	33	7	9	3	C PS
86 SW 641	3.1	0.9	36	58	3	1	2	0	VC S
87 NE 76	2.3	5.3	34	12	16	15	13	10	VC SG
96 NE 3	1.3	8.7+	11	15	36	17	15	6	C PS
96 NE 5	1.4	3.3	15	16	51	7	10	1	C PS
96 NE 6	1.2	2.5	14	43	39	2	1	1	C S
96 SW 51	3.1	1.3	30	19	19	9	15	8	VC SG
96 SW 53	0.2	0.7	40	22	24	8	4	2	VC S
96 SW 57	2.7	2.5	14	16	36	17	15	2	C PS
96 SW 58	2.5	7.7	7	8	40	18	22	5	SG
96 SW 59	3.0	1.4	7	14	36	16	23	4	SG
97 NE 163*	6.1	1.6	3	6	44	20	25	2	SG
07 NW 37	0.3	1.3	38	14	22	17	9	0	VC PS
07 NW 39	9.1	3.5	5	10	48	15	20	2	PS
07 NW 41	4.3	6.1	5	7	43	16	27	2	SG
Mean	**2.8**	**3.2**	**14**	**15**	**36**	**14**	**17**	**4**	**C PS**

* classified as waste in the log
\+ indicates that the base of the deposit was not reached

Key to abbreviations C 'Clayey' G Gravel S Sand/sandy VC 'Very clayey' P Pebbly

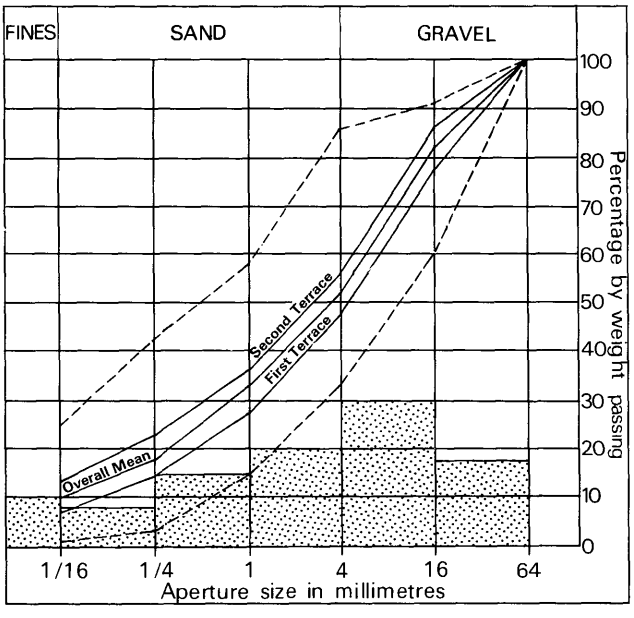


Figure 6 Grading characteristics of the resources within Block B (based on 11 boreholes). For explanation see Figure 5.

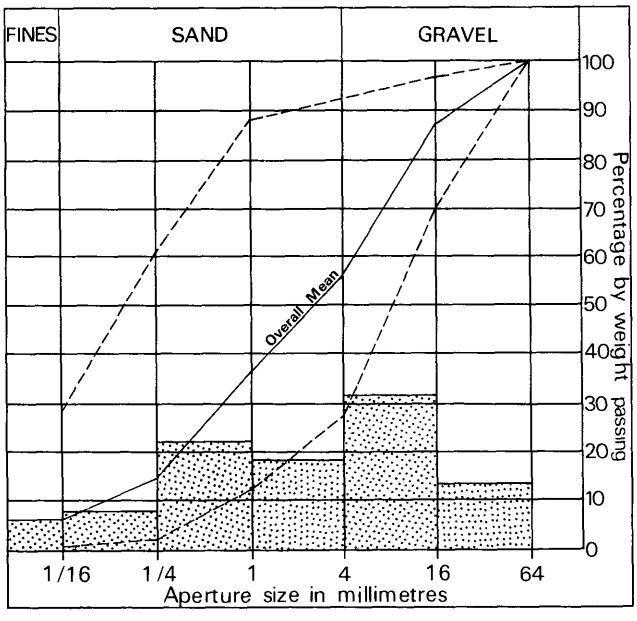


Figure 7 Grading characteristics of the resources within Block C (based on 30 boreholes). For explanation see Figure 5.

Because of the sporadic distribution of the exposed Glacial Sand and Gravel in this block, its unpredictable occurrence beneath overburden and the relatively few IMAU data points within such a large area, only a speculative volume estimate has been made (Table 3). However, in the 15 IMAU boreholes proving mineral, the mean thickness was 3.2 m and the mean grading was fines 14 per cent, sand 65 per cent and gravel 21 per cent (Figure 8 and Table 7). The mean thickness of overburden was 2.8 m.

The dissimilarity in the mean particle-size distribution of the mineral between block D and the other resource blocks is shown in Figure 9.

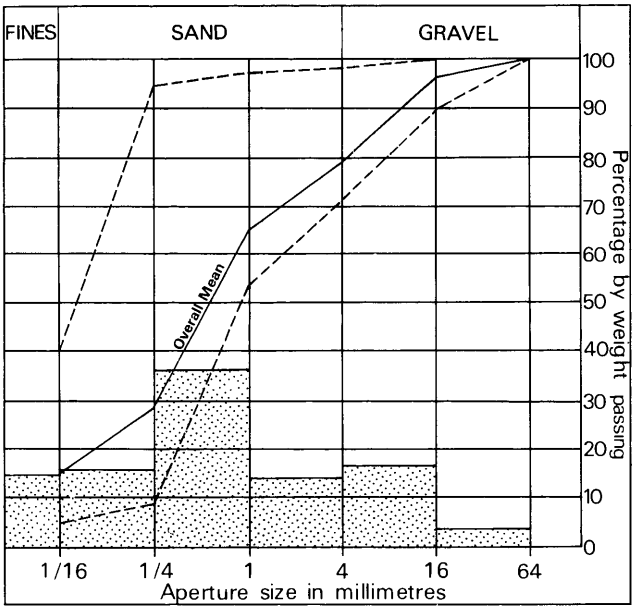
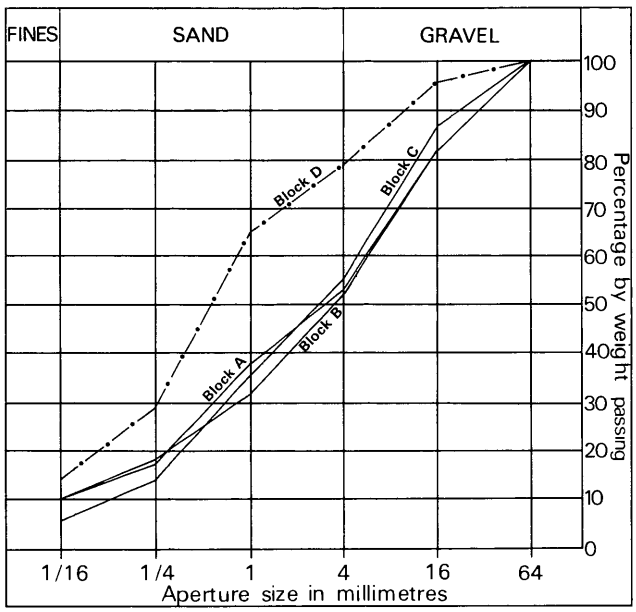


Figure 8 Grading characteristics of the resources withing Block D (based on 15 boreholes). For explanation see Figure 5.



Resource Block	Percentage by weight passing				
	$\frac{1}{16}$ mm	$\frac{1}{4}$ mm	1 mm	4 mm	16 mm
A (31)*	10	17	38	53	82
B (11)*	10	18	32	52	82
C (30)*	6	14	36	55	87
D (15)†	14	29	65	79	96

* sample density at the indicated level

† sample density at the inferred level

Figure 9 Mean particle-size distribution of the mineral in Blocks A to D (figures in brackets show the number of sample points for which grading data are available).

REFERENCES

ALLEN, V. T. 1936. Terminology of medium-grained sediments. **Rep. Natl Res. Counc., Washington, 1935-1936,** App. 1, Rep. Comm. Sediment., 18-47.

ARCHER, A. A. 1969. Background and problems of an assessment of sand and gravel resources in the United Kingdom. **Proc. 9th Commonw. Min. & Metall. Congr., 1969**, Vol. 2: Mining and petroleum geology, 495-508.

— 1970a. Standardisation of the size classification of naturally occurring particles. **Geotechnique**, Vol. 20, 103-107.

— 1970b. Making the most of metrication. **Quarry Managers' J.**, Vol. 54, No. 6, 223-227.

ATTERBERG, A. 1905. Die rationelle Klassifikation der Sande und Kiese. **Chem. Z.**, Vol. 29, 195-198.

BRITISH STANDARDS INSTITUTION. 1967. **B.S.1377: Methods of testing soils for civil engineering purposes.** (London: British Standards Institution.)

BUREAU OF MINES AND GEOLOGICAL SURVEY. 1948. **Pp. 14-17** in **Mineral resources of the United States.** (Washington, DC: Public Affairs Press.)

HARRIS, P. M., THURRELL, R. G., HEALING, R. A., and ARCHER, A. A. 1974. Aggregates in Britain. **Proc. R. Soc.**, Ser. A, Vol. 339, 329-353.

HOLLINGWORTH, S. E. and TAYLOR, J. H. 1946. An outline of the geology of the Kettering district. **Proc. Geol. Soc.**, Vol. 57, 204-233.

HULL, J. H. 1981. Methods of calculating the volume of resources of sand and gravel. **Appendix** (pp. 192-193) to THURRELL, R. G. 1981. Quarry resources and reserves: the identification of bulk mineral resources: the contribution of the Institute of Geological Sciences. **Quarry Management**, for March 1981, 181-193.

LANE, E. W., and others. 1947. Report of the sub-committee on sediment terminology. **Trans. Am. Geophys. Union**, Vol. 28, 936-938.

PETTIJOHN, F. J. 1975. **Sedimentary rocks.** 3rd edition. (London: Harper and Row.)

TAYLOR, J. H. 1963. Geology of the country around Kettering, Corby and Oundle. **Mem. Geol. Surv. G. B.**, Sheet 171.

THURRELL, R. G. 1971. The assessment of mineral resources with particular reference to sand and gravel. **Quarry Managers' J.**, Vol. 55, 19-25.

— 1981. Quarry resources and reserves: the identification of bulk mineral resources: the contribution of the Institute of Geological Sciences. **Quarry Management**, for March 1981, 181-193.

TWENHOFEL, W. H. 1937. Terminology of the fine-grained mechanical sediments. **Rep. Natl Res. Counc., Washington, 1936-37**, App. 1, Rep. Comm. Sediment., 81-104.

UDDEN, J. A. 1914. Mechanical composition of clastic sediments. **Bull. Geol. Soc. Am.**, Vol. 25, 655-744.

WENTWORTH, C. K. 1922. A scale of grade and class terms for clastic sediments. **J. Geol.**, Vol. 30, 377-392.

— 1935. The terminology of coarse sediments. **Bull. Natl. Res. Counc. Washington**, No. 98, 225-246.

WILLMAN, H. B. 1942. Geology and mineral resources of the Marseilles, Ottawa and Streator quadrangles. **Bull. Illinois State Geol. Surv.**, No. 66, 343-344.

APPENDIX A

FIELD AND LABORATORY PROCEDURES

Trial and error during initial studies of the complex and variable glacial deposits of East Anglia and Essex showed that an absolute minimum of five sample points evenly distributed across the sand and gravel are needed to provide a worthwhile statistical assessment, but that, where possible, there should be not less than ten. Sample points are any points for which adequate information exists about the nature and thickness of the deposit and may include boreholes other than those drilled during the survey and exposures. In particular, the cooperation of sand and gravel operators ensures that boreholes are not drilled where reliable information is already available; although this may be used in the calculations, it is held confidentially by the Institute and cannot be disclosed.

The mineral shown on each 1:25 000 sheet is divided into resource blocks. The arbitrary size selected is a compromise to meet the aims of the survey by providing sufficient sample points in each block. As far as possible the block boundaries are determined by geological boundaries so that, for example, glacial and river terrace gravels are separated. Otherwise division is by arbitrary lines, which may bear no relationship to the geology. Exceptionally, other schemes for subdividing the resource sheet area (for example, the use of 'resource sub-blocks') may be used where these are considered to be more appropriate.

A reconnaissance of the ground is carried out to record any exposures and inquiries are made to ascertain what borehole information is available. Borehole sites are then selected to provide an even pattern of sample points at a density of approximately one per square kilometre. However, because broad trends are independently overlain by smaller-scale characteristically random variations, it is unnecessary to adhere to a square grid pattern. Thus such factors as ease of access and the need to minimise disturbance to land and the public are taken into account in siting the holes; at the same time it is necessary to guard against the possibility that ease of access (that is, the positions of roads and farms) may reflect particular geological conditions, which may bias the drilling results.

The drilling machine employed should be capable of providing a continuous sample representative of all unconsolidated deposits, so that the in-situ grading can be determined, if necessary, to a depth of 30 m (100 ft) at a diameter of about 200 mm (8 in), beneath different types of overburden. It should be reliable, quiet, mobile and relatively small (so that it can be moved to sites of difficult access). Shell and auger rigs have proved to be almost ideal.

The rigs are modified to enable deposits above the water table to be drilled 'dry', instead of with water added to facilitate the drilling, to minimise the amount of material drawn in from outside the limits of the hole. The samples thus obtained are representative of the in-situ grading, and satisfy one of the most important aims of the survey. Below the water table the rigs are used conventionally, although this may result in the loss of some of the fines fraction and the pumping action of the bailer tends to draw unwanted material into the hole from the sides or the bottom.

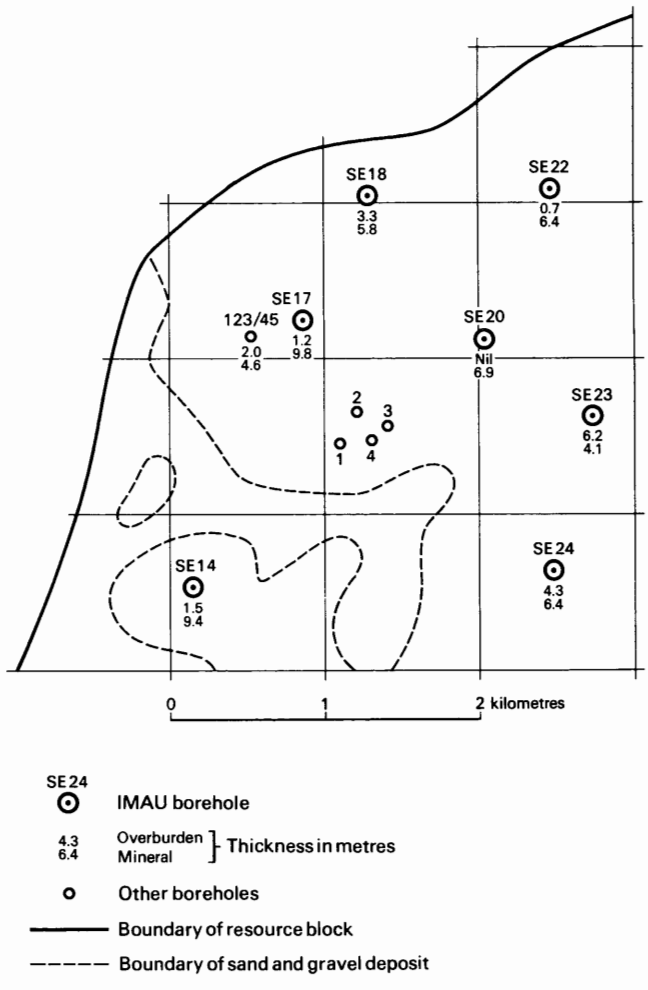
A continuous series of bulk samples is taken throughout the sand and gravel. Ideally samples are composed exclusively of the whole of the material encountered in the borehole between stated depths. However, care is taken to discard, as far as possible, material which has caved or has been pumped from the bottom of the hole. A new sample is commenced whenever there is an appreciable lithological change within the sand and gravel, or at every 1 m depth. The samples, each weighing between 25 and 45 kg, are despatched in heavy-duty polythene bags to a laboratory for grading. The grading procedure is based on B.S. 1337 (British Standards Institution, 1967). Random checks of the accuracy of the grading are made in the Institute's laboratories.

All data, including mean grading analysis figures calculated for the total thickness of the mineral, are entered on standard record sheets, abbreviated copies of which are reproduced in Appendix E.

Detailed records may be consulted at the appropriate offices of the Institute, upon application to the Head, Industrial Minerals Assessment Unit.

Other methods of drilling and sampling are occasionally employed, for example the Minuteman power auger rig, and downhole tests such as U4 and SPT may be carried out. The Minuteman, which is small and portable, is normally used when access to land with shell rigs would be difficult to arrange and when information is requested quickly.

The auger tool comprises a continuous-'flight' 76-mm spiral auger; the use of this equipment, as with all 'open-hole' drilling methods, inevitably leads to the mixing and contamination of the sampled material. Thus, data relating to depth and composition cannot always be accurately determined.



Example of resource block assessment: map of a fictitious block

APPENDIX B

STATISTICAL PROCEDURE

Statistical assessment

1 A statistical assessment is made of an area of mineral greater than 2 km^2, if there are at least five evenly spaced boreholes in the resource block (for smaller areas, see Paragraph 12 below).

2 The simple methods used in the calculations are consistent with the amount of data provided by the survey (Hull, 1981). Conventional symmetrical confidence limits are calculated for the 95 per cent probability level, that is, on average nineteen out of every twenty sets of limits constructed in this way contain the true value for the volume of mineral.

3 The volume estimate (V) for the mineral in a given block is the product of two variables, the sampled areas (A) and the mean thickness ($\bar{l}_m$) calculated from the individual thicknesses at the sample points. The standard deviations for these variables are related such that

$$S_V = \sqrt{(S_A^2 + S\bar{l}_m^2)} \qquad [1]$$

4 The above relationship may be transposed such that

$$S_V = S\bar{l}_m \sqrt{(1 + S_A^2 / S\bar{l}_m^2)} \qquad [2]$$

From this it can be seen that as $S_A^2 / S\bar{l}_m^2$ tends to 0, S_V tends to $S\bar{l}_m$.

If, therefore, the standard deviation for area is small with respect to that for thickness, the standard deviation for volume approximates to that for mean thickness.

5 Given that the number of approximately evenly spaced sample points in the sampled area is n with mineral thickness measurements $l_{m_1}, l_{m_2}, \ldots l_{m_n}$, then the best estimate of mean thickness, $\bar{l}_m$, is given by

$$\Sigma\ (l_{m_1} + l_{m_2} \ldots l_{m_n}) / n .$$

For groups of closely spaced boreholes a discretionary weighting factor may be applied to avoid bias (see note on weighting below). The standard deviation for mean thickness $S\bar{l}_m$, expressed as a proportion of the mean thickness, is given by

$$S\bar{l}_m = (1/\bar{l}_m) \sqrt{\ [\Sigma (l_m - \bar{l}_m)^2/(n-1)]}$$

where l_m is any value in the series l_{m_1} to l_{m_n}.

6 The sampled area in each resource block is coloured pink on the map. Wherever possible, calculations relate to the mineral within mapped geological boundaries (which may not necessarily correspond to the limits of a deposit). Where the area is not defined by a mapped boundary, that is, where the boundary is inferred, a distinctive symbol is used. Experience suggests that the errors in determining area are small relative to those in thickness. The relationship $S_A / S\bar{l}_m \leqq 0.\dot{3}$ is assumed in all cases. It follows from Equation [2] that

$$S\bar{l}_m \leqq S_V \leqq 1.05\ S\bar{l}_m \qquad [3]$$

7 The limits on the estimate of mean thickness of mineral, $L\bar{l}_m$, may be expressed in absolute units

$\pm (t/\sqrt{n}) \times S\bar{l}_m$ or as a percentage

$\pm (t/\sqrt{n}) \times S\bar{l}_m \times (100/\bar{l}_m)$ per cent, where t is Student's t at the 95 per cent probability level for $(n-1)$ degrees of freedom, evaluated by reference to statistical tables. (In applying Student's t it is assumed that the measurements are distributed normally).

8 Values of t at the 95 per cent probability level for values of n up to 20 are as follows:

n	t	n	t
1	infinity	11	2.228
2	12.706	12	2.201
3	4.303	13	2.179
4	3.182	14	2.160
5	2.776	15	2.145
6	2.571	16	2.131
7	2.447	17	2.120
8	2.365	18	2.110
9	2.306	19	2.101
10	2.262	20	2.093

(from Table 12 in *Biometrika Tables for Statisticians*, Volume 1, Second Edition, Cambridge University Press, 1962). When n is greater than 20, 1.96 is used (the value of t when n is infinity).

9 In calculating confidence limits for volume, L_V, the following inequality, corresponding to Equation [3], is applied:

$$L\bar{l}_m \leqq L_V \leqq 1.05\ L\bar{l}_m .$$

10 In summary, for values of n between 5 and 20, L_V is calculated as

$$[(1.05 \times t)/\bar{l}_m] \times [\sqrt{\Sigma(l_m - \bar{l}_m)^2/n\ (n-1)}] \times 100$$

per cent,

and when n is greater than 20, as

$$[(1.05 \times 1.96)/\bar{l}_m] \times [\sqrt{\Sigma(l_m - \bar{l}_m)^2/n\ (n-1)}] \times 100$$

per cent.

11 The application of this procedure to a fictitious area is illustrated in the accompanying Figure and example of a block calculation.

Inferred assessment

12 If the sampled area of mineral in a resource block is between 0.25 km^2 and 2 km^2, an assessment is inferred on the basis of geological and topographical information, usually supported by the data from one or two boreholes. The volume of mineral is calculated as the product of the area, measured from field data, and the estimated thickness. Confidence limits are not calculated.

13 In some cases a resource block may include an area left uncoloured on the map, within which mineral (as defined) is interpreted to be generally absent. If there is reason to believe that some mineral may be present, an inferred assessment may be made.

14 No assessment is attempted for an isolated area of mineral less than 0.25 km^2.

15 Note on weighting The thickness of a deposit at any point may be governed solely by the position of the point in relation to a broad trend. However, most sand and gravel deposits also exhibit a random pattern of local, and sometimes considerable, variation in thickness. Thus the distribution of sample points needs to be only approximately regular and in estimating the mean thickness only simple weighting is necessary. In practice, equal weighting can often be applied to thicknesses at all sample points. If, however, there is a distinctly unequal distribution of points, bias is avoided by dividing the sampled area into broad zones, to each of which a value roughly proportional to its area is assigned. This value is then shared between the data points with the zone as the weighting factor.

Block calculation

Scale: 1:25 000
Block: Fictitious

Area
Block: 11.08 km²
Mineral: 8.32 km²

Mean thickness
Overburden: 2.5 m
Mineral: 6.5 m

Volume
Overburden: 21 million m³
Mineral: 54 million m³

Confidence limits of the estimate of mineral volume at the 95 per cent probability level: ± 20 per cent
That is, the volume of mineral (with 95 per cent probability): 54 ± 11 million m³

Thickness estimate (measurements in metres)
l_o= overburden thickness l_m = mineral thickness

Sample point	Weighting w	Overburden l_o	Overburden wl_o	Mineral l_m	Mineral wl_m	Remarks
SE 14	1	1.5	1.5	9.4	9.4	IMAU boreholes
SE 18	1	3.3	3.3	5.8	5.8	
SE 20	1	nil	-	6.9	6.9	
SE 22	1	0.7	0.7	6.4	6.4	
SE 23	1	6.2	6.2	4.1	4.1	
SE 24	1	4.3	4.3	6.4	6.4	
SE 17	½	1.2	1.6	9.8	7.2	
123/45	½	2.0		4.6		Hydrogeology Unit record
1	¼	2.7	2.6	7.3	5.8	Close group of four boreholes (commercial)
2	¼	4.5		3.2		
3	¼	0.4		6.8		
4	¼	2.8		5.9		
Totals	$\Sigma w = 8$	$\Sigma wl_o = 20.2$		$\Sigma wl_m = 52.0$		
Means		$\overline{wl}_o = 2.5$		$\overline{wl}_m = 6.5$		

Calculation of confidence limits

wl_m	$\lvert(wl_m - \overline{wl}_m)\rvert$	$(wl_m - \overline{wl}_m)^2$
9.4	2.9	8.41
5.8	0.7	0.49
6.9	0.4	0.16
6.4	0.1	0.01
4.1	2.4	5.76
6.4	0.1	0.01
7.2	0.7	0.49
5.8	0.7	0.49

$\Sigma(wl_m - \overline{wl}_m)^2 = 15.82$

$n = 8$

$t = 2.365$

L_V is calculated as

$1.05\,(t/\overline{wl}_m)\sqrt{[\Sigma(wl_m - \overline{wl}_m)^2/\,n(n-1)]} \times 100$

$= 1.05 \times (2.365/6.5)\sqrt{[15.82/(8 \times 7)]} \times 100$

$= 20.3$

$\simeq 20$ per cent.

APPENDIX C

CLASSIFICATION AND DESCRIPTION OF SAND AND GRAVEL

For the purposes of assessing resources of sand and gravel a classification should take account of economically important characteristics of the deposit, in particular the absolute content of fines and the ratio of sand to gravel.

The terminology commonly used by geologists when describing sedimentary rocks (Wentworth, 1922) is not entirely satisfactory for this purpose. For example, Wentworth proposed that a deposit should be described as a 'gravelly sand' when it contains more sand than gravel and there is at least 10 per cent of gravel, provided that there is less than 10 per cent of material finer than sand (< $\frac{1}{16}$ mm) and coarser than pebbles (> 64 mm in diameter). Because deposits containing more than 10 per cent fines are not embraced by this system, a modified binary classification based on Willman (1942) has been adopted.

When the fines content exceeds 40 per cent the material is considered to be not potentially workable and falls outside the definition of mineral. Deposits which contain 40 per cent fines or less are classified primarily on the ratio of sand to gravel but qualified in the light of the fines content, as follows: less than 10 per cent fines - no qualification; 10 per cent or more but less than 20 per cent fines - 'clayey'; 20 to 40 per cent fines - 'very clayey'.

The term 'clay' (as written, with single quote marks) is used to describe all material passing $\frac{1}{16}$ mm. Thus it has no mineralogical significance and includes particles falling within the size range of silt. The normal meaning applies to the term clay where it does not appear in single quotation marks.

The ratio of sand to gravel defines the boundaries between sand, pebbly sand, sandy gravel and gravel (at 19:1, 3:1 and 1:1).

Thus it is possible to classify the mineral into one of twelve descriptive categories (see the accompanying Figure). The procedure is as follows:

1 Classify according to the ratio of sand to gravel.
2 Describe the fines.

For example, a deposit grading 11 per cent gravel, 70 per cent sand and 19 per cent fines is classified as 'clayey' pebbly sand. This short description is included in the borehole log (see Appendix D)

Many differing proposals have been made for the classification of the grain size of sediments (Atterberg, 1905; Udden, 1914; Wentworth, 1922; Wentworth, 1935; Allen, 1936; Twenhofel, 1937; Lane and others, 1947). As Archer (1970a, b) has emphasised, there is a pressing need for a simple metric scale acceptable to both scientific and engineering interests, for which the class limit sizes correspond closely with certain marked changes in the natural properties of mineral particles. For example, there is an important change in the degree of cohesion between particles at about the $\frac{1}{16}$-mm size, which approximates to the generally accepted boundary between silt and sand. These and other requirements are met by a system based on Udden's geometric scale and a simplified form of Wentworth's terminology (see the accompanying table), which is used in the Report.

The fairly wide intervals in the scale are consistent with the general level of accuracy of the qualitative assessments of the resource blocks. Three sizes of sand are recognised, fine (+$\frac{1}{16}$ -$\frac{1}{4}$ mm), medium (+$\frac{1}{4}$ -1 mm) and coarse (+1 -4 mm). The boundary at 16 mm distinguishes a range of finer gravel (+4 -16 mm), often characterised by abundance of worn tough pebbles of vein quartz, from larger pebbles, often of notably different materials. The boundary at 64 mm distinguishes pebbles from cobbles. The term 'gravel' is used loosely to denote both pebble-sized and cobble-sized material.

The size distribution of borehole samples is determined by sieve analysis, which is presented by the laboratory as logarithmic cumulative curves (see, for example, British Standards Institution, 1967). In this report the grading is tabulated on the borehole record sheets (Appendix E), the intercepts corresponding with the simple geometric scale $\frac{1}{16}$ mm, $\frac{1}{4}$ mm, 1 mm, 4 mm, 16 mm and so on as required. Original sample grading curves are available for reference at the appropriate office of the Institute.

Each bulk sample is described, subjectively, by a geologist at the borehole site. Being based on visual examination, the description of the grading is inexact, the accuracy depending on the experience of the observer. The descriptions recorded are modified, as necessary, when the laboratory results become available.

The relative proportions of the rock types present in the gravel fraction are indicated by the use of the words 'and' or 'with'. For example, 'flint and quartz' indicates roughly equal proportions with neither constituent accounting for less than about 25 per cent of the whole; 'flint with quartz' indicates that flint is dominant and quartz, the principal accessory rock type, comprises 5 to 25 per cent of the whole. Where the accessory material accounts for less than 5 per cent of the whole, but is still readily apparent, the phrase 'with some' has been used. Rare constitutents are referred to as 'trace'.

The terms used in the field to describe the degree of rounding of particles, which is concerned with the sharpness of the edges and corners of a clastic fragment and not the shape (after Pettijohn, 1975), are as follows.

Angular: showing little or no evidence of wear; sharp edges and corners.

Subangular: showing definite effects of wear. Fragments still have their original form but edges and corners begin to be rounded off.

Subrounded: showing considerable wear. The edges and corners are rounded off to smooth curves. Original grain shape is still distinct.

Rounded: original faces almost completely destroyed, but some comparatively flat surfaces may still remain. All original edges and corners have been smoothed off to rather broad curves. Original shape is still apparent.

Well rounded: no original faces, edges or corners left. The entire surface consists of broad curves; flat areas are absent. The original shape is suggested by the present form of the grain.

Classification of gravel, sand and fines

Size limits	Grain-size description	Qualification	Primary classification
	Cobble		
64 mm			
		Coarse	Gravel
16 mm	Pebble		
		Fine	
4 mm			
		Coarse	
1 mm			
	Sand	Medium	Sand
$\frac{1}{4}$ mm			
		Fine	
$\frac{1}{16}$ mm			
	Fines (silt and clay)		Fines

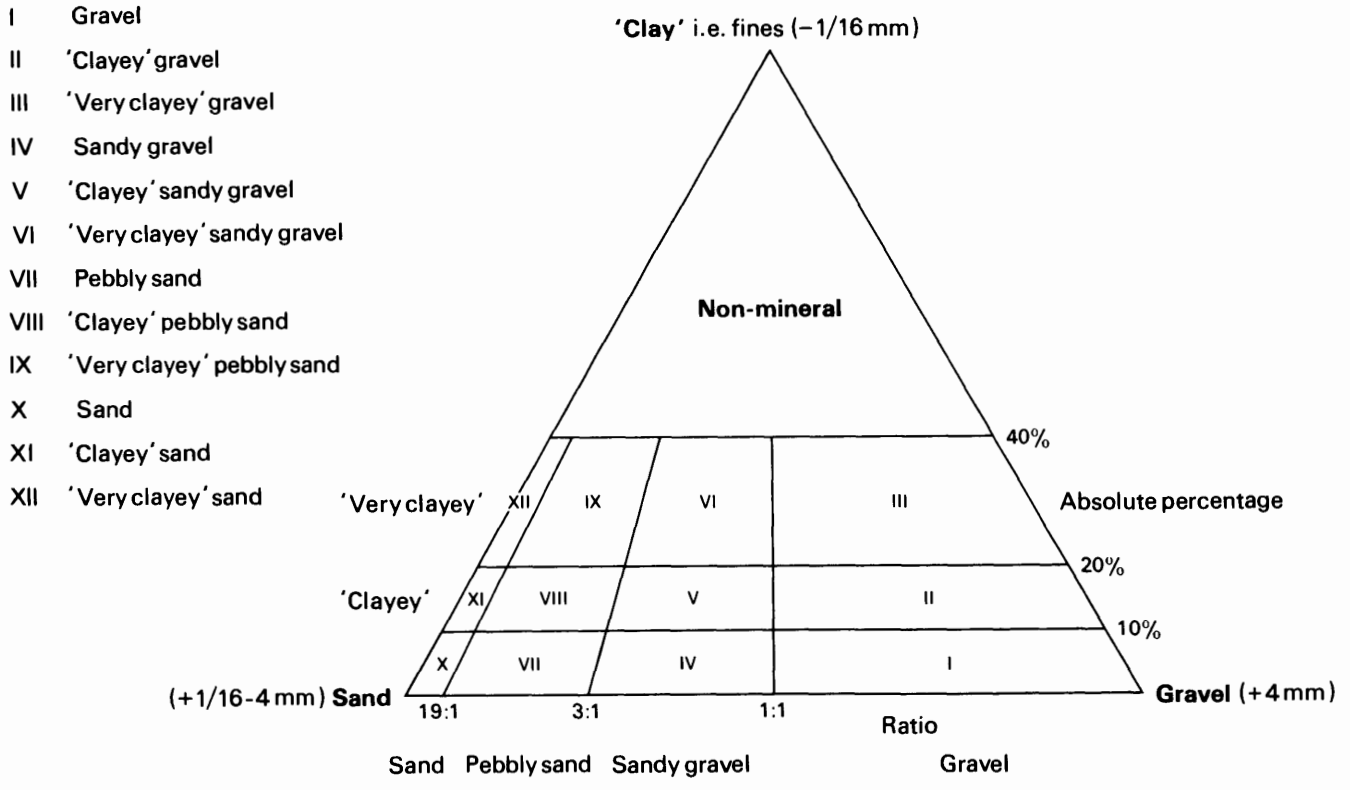


Diagram showing the descriptive categories used in the classification of sand and gravel

APPENDIX D

EXPLANATION OF THE BOREHOLE RECORDS

Annotated fictitious example

CK 66 NW 5[1] **6191 6962**[2] **Northfields**[3] **Block B**

Surface level (+49.7 m) +163 ft[4]
Water struck at +45.9 m[5]
October 1972[6]

Overburden[7]	2.8 m
Mineral	5.4 m
Waste	1.1 m
Mineral	1.4 m
Bedrock	0.7 m+[8]

LOG

Geological classification	Lithology[9]	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, silty, dark brown	2.6	2.8
River Terrace Deposits	**a** Gravel Gravel: fine to coarse, with cobbles towards base, angular to rounded flint and limestone with ironstone and some quartz and chalk Sand: medium with coarse and some fine, quartz and limestone	5.4	8.2
Boulder Clay	Clay, sandy and pebbly, red-brown	1.1	9.3
Glacial Sand and Gravel	**b** Sand, 'clayey' in part: fine, subangular to rounded, quartz with some coal	1.4	10.7
Lias	Mudstone, blue-grey, fossiliferous	0.7+	11.4

GRADING[10]

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	5	46	49	2.8-3.9	20	14	62	2	2	0	0
				3.8-4.8	2	2	12	18	42	24	0
				4.8-5.8	1	3	24	13	35	24	0
				5.8-6.8	0	4	21	20	26	29	0
				6.8-8.2	4	3	23	10	23	30	7
				Mean	**5**	**5**	**28**	**13**	**25**	**22**	**2**
b	5	95	0	9.3-10.3	3	73	23	1	0	0	0
				10.3-10.7	9	85	5	1	0	0	0
				Mean	**5**	**77**	**17**	**1**	**0**	**0**	**0**
a+b	**5**	**56**	**39**	**Mean**	**5**	**20**	**26**	**10**	**20**	**17**	**2**

COMPOSITION[11]

	percentages by weight in the +4-16 mm fraction				
	Flint	Quartz	Limestone	Chalk	Ironstone
a+b	41	5	50	1	3

The numbered paragraphs below correspond with the annotations given on the specimen record opposite.

1 Borehole Registration Number
Each Industrial Minerals Assessment Unit (IMAU) borehole is identified by a Registration Number. This consists of two statements.

a The number of the 1:25 000 sheet on which the borehole lies, here CK 66.
b The quarter of the 1:25 000 sheet on which the borehole lies and the number of the borehole in a series for that quarter, here NW 5.

Thus the full Registration Number is CK 66 NW 5.

2 National Grid Reference
All National Grid References fall in the 100 km square identified by the first two letters of the Registration Number. Grid references are given to eight figures, accurate to within 10 m.

3 Location
The position of the borehole is generally referred to the nearest named locality on the 1:25 000 base map and the resource block in which the borehole lies is stated.

4 Surface level
The surface level at the borehole site is given in metres and feet above Ordnance Datum. All measurements were made in feet; approximate conversions to metres are given in brackets.

5 Groundwater conditions
If groundwater was present the level at which it was encountered is normally given (in metres relative to Ordnance Datum).

6 Type of drill and date of drilling
The type of rig used, the diameter of the casing and the month and year of completion of drilling are stated.

7 Overburden, mineral, waste and bedrock
Mineral is sand and gravel which, as part of a deposit, falls within the arbitrary definition of potentially workable material (see p. 1). Bedrock is the 'formation', 'country rock' or 'rock head' below which potentially workable sand and gravel will not be found. Waste is any material other than bedrock or mineral. Where waste occurs between the surface and mineral it is classified as overburden.

8 The plus sign (+) indicates that the base of the deposit was not reached during drilling.

9 Lithological description
When sand and gravel is recorded a general description based on the grading characteristics (for details see Appendix C) is followed by more detailed particulars of the gravel and/or sand fraction. Where more than one bed of mineral is recognised each is designated by a letter, e.g. **a, b,** etc. The description of other deposits is based on visual examination in the field.

10 Grading data
A continuous series of bulk samples is taken throughout the thickness of sand and gravel. A new sample is commenced whenever there is an appreciable lithological change or at every 1 m of depth.

For each bulk sample the percentages of fines ($-\frac{1}{16}$ mm), fine sand ($+\frac{1}{16}$-$\frac{1}{4}$ mm), medium sand ($+\frac{1}{4}$-1 mm), coarse sand (+1-4 mm), fine gravel (+4-16 mm), coarse gravel (+16-64 mm) and cobble gravel (+64 mm) are stated.

The mean grading of groups of samples making up an identified bed of mineral are also given in detail and in summary. Where more than one bed is recognised the mean grading for the whole of the mineral in the borehole may be given. Where necessary, in calculating mean gradings, data for individual samples are weighted by the thickness represented. If,exceptionally, grading results are not available for a sample, an attempt may be made to estimate the grading by comparing the grading and field descriptions of adjacent samples with the sample in question. Such estimates are shown in square brackets. Alternatively, in calculating means, the sample may be allotted the mean grading of other samples in the deposit.

Fully representative sampling of sand and gravel is difficult to achieve, particularly where groundwater levels are high. Comparison between boreholes and adjacent exposures commonly suggests that in borehole samples the proportion of sand may be higher and the proportion of fines and coarse gravel may be lower.

11 Composition
Details of the composition of selected samples or groups of samples may be given.

APPENDIX E

INDUSTRIAL MINERALS ASSESSMENT UNIT BOREHOLE RECORDS

SP 86 NW 51 **8306 6648** **Mears Ashby** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.7 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Alluvium	Silt, soft, dark brown, clayey, with fine flint pebbles and shell fragments	1.3	1.3
	Clay, brown, containing pebbles of ironstone and limestone with quartzite	1.0	2.3
	Clay, soft, grey-brown, sandy	0.4	2.7
Upper Lias	Clay, stiff, dark blue-grey	0.3+	3.0

SP 86 NE 76 **8762 6513** **Great Doddington** **Block D**

Surface level (+95.1 m) +312 ft
Water not struck
203 mm percussion
May 1974

Waste 4.3 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, firm, pale brown, with chalk and flint pebbles	4.0	4.3
Upper Lias	Clay, firm, blue-grey	0.7+	5.0

SP 86 NE 77 **8924 6607** **Wellingborough** **Block D**

Surface level (+61.3 m) +201 ft
Water not struck
203 mm percussion
May 1974

Waste 2.7 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay with chalk and sand, pale brown	2.4	2.7
Upper Lias	Clay, firm, blue-grey	0.9+	3.6

SP 86 NE 78 **8979 6643** **Wellingborough** **Block A**

Surface level (+40.8 m) +134 ft
Water struck at (+38.9 m)
203 mm percussion
May 1974

Overburden 1.5 m
Mineral 2.8 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.5	1.5
River Gravel (First Terrace)	Gravel, hard packed below 3.0 m Gravel: fine to coarse, subangular and rounded, flint, ironstone and quartzite Sand: medium to coarse, subangular to rounded, flint, quartz and ironstone	2.8	4.3
Upper Lias	Clay, firm, blue-grey	0.7+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
1	36	63	1.5-3.0	1	2	15	19	36	27	
			3.0-4.3	No grading data available						

SP 86 NE 106 **8741 6654** **Wilby** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 3.0 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, brown, silty	1.1	1.1
Alluvium	Silt, soft, with scattered chalk clasts	1.4	2.5
	Clay, soft, light brown, sandy, pebbly	0.5	3.0
Upper Lias	Clay, firm to stiff, blue-grey	0.5+	3.5

SP 86 NE 107 **8674 6926** **Wellingborough** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 4.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, firm, light to medium brown becoming grey-brown with depth, silty, with fine pebbles of chalk, flint, ironstone and limestone. Scattered silt and carbon patches	4.2+	4.2

SP 86 SW 632 **8012 6183** **Little Billing** **Block A**

Surface level (+55.5 m) +182 ft
Water struck at (+52.4 m)
203 mm percussion
May 1974

Overburden 1.9 m
Mineral 2.4 m
Waste 9.7 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Alluvium	Clay, silty, firm, yellow-brown	0.4	0.9
	Clay and silt, ferruginous, with some sand	1.0	1.9
River Gravel (First Terrace)	Sandy gravel Gravel: fine to coarse, subangular to rounded, flint and ironstone with quartz and quartzite Sand: fine to coarse, subangular and angular, flint and quartz with ironstone	2.4	4.3
River Channel Infill	Silts and clays, micaceous, medium grey, laminated	9.7	14.0
Upper Lias	Clay, stiff, dark grey	0.5+	14.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	47	46	1.9-2.9	13	12	38	11	23	3	
			3.0-4.0	3	3	14	19	39	22	
			4.0-4.3	5	3	15	18	42	17	
			Mean	**7**	**7**	**25**	**15**	**33**	**13**	

SP 86 SW 633 **8076 6108** **Little Billing** **Block A**

Surface level (51.8 m) +170 ft
Water struck at (+48.8 m)
203 mm percussion
November 1974

Overburden 3.0 m
Mineral 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and subsoil	1.2	1.2
Alluvium	Clay, silty, stiff, blue-grey	1.8	3.0
River Gravel (First Terrace)	Gravel Gravel: fine to coarse, subangular flint, subrounded quartz and ironstone Sand: medium to coarse, subangular, flint and quartz Hole abandoned in rising gravel	1.0+	4.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
1	30	69	3.0-4.0	1	0	9	21	43	26	

SP 86 SW 634 **8068 6034** **Little Houghton** **Block A**

Surface level (+57.3 m) +188 ft
Groundwater conditions not recorded
203 mm percussion
May 1974

Overburden 0.8 m
Mineral 0.7 m
Waste 1.0 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
River Gravel (First Terrace)	'Very clayey' pebbly sand Gravel: mainly fine, angular flint with ironstone and limestone Sand: fine and medium, subangular to rounded, flint, quartz and ironstone	0.7	1.5
	Clay, yellowish grey, with pebbles including chalk	1.0	2.5
Upper Lias	Clay, firm, blue-grey	0.5+	3.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
23	60	17	0.8-1.5	23	22	27	11	14	3	

SP 86 SW 635 **8133 6233** **Great Billing** **Block A**

Surface level (+65.8 m) +216 ft
Water struck at (+61.6 m)
203 mm percussion
November 1974

Overburden 0.5 m
Mineral 2.0 m
Waste 6.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
River Gravel (Second Terrace)	'Clayey' sandy gravel Gravel: fine to coarse, subrounded, quartz and flint, ironstained Sand: medium, tabular quartz with flint	2.0	2.5
	Clay, sandy, firm, medium brown, laminated	3.8	6.3
River Channel Infill	Clay, grey-brown, laminated	2.7+	9.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
15	54	31	0.5-1.5	10	11	35	12	26	6	
			1.5-2.5	20	9	25	16	25	5	
			Mean	**15**	**10**	**30**	**14**	**25**	**6**	

SP 86 SW 636 **8155 6171** **Great Billing** **Block A**

Surface level (+52.1 m) +171 ft
Water struck at (+48.9 m)
203 mm percussion
May 1974

Overburden 1.0 m
Mineral 2.5 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Clay, sandy, with angular flint and ironstone pebbles	0.9	1.0
River Gravel (First Terrace)	'Clayey' sandy gravel Gravel: mainly fine, subangular and angular, flint, ironstone and quartzite Sand: fine to medium, subangular to rounded, flint, quartz and ironstone	2.5	3.5
Upper Lias	Clay, firm, dark blue-grey	0.1+	3.6

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
10	48	42	1.0-3.0	8	6	24	17	29	16	
			3.0-3.5	20	10	29	13	22	6	
			Mean	**10**	**7**	**25**	**16**	**28**	**14**	

SP 86 SW 637 **8149 6103** **Little Billing** **Block A**

Surface level (+51.2 m) +168 ft
Water struck at (+50.2 m)
203 mm percussion
November 1974

Overburden 3.3 m
Mineral 2.2 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.8	0.8
Alluvium	Clay, sandy, soft, yellow-brown, with isolated flint and ironstone pebbles and shell debris	1.1	1.9
	Silt, clayey, sandy, dark grey, with peat bands and white gastropod shells at base	1.4	3.3
River Gravel (First Terrace)	Gravel Gravel: fine to coarse with cobbles, well rounded sandstone and quartzite, angular ironstone and flint, rare chalk Sand: medium to coarse, angular and subangular, quartz and flint with ironstone	2.2	5.5
Upper Lias	Clay, firm, blue-grey	0.5+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
1	17	82	3.3-4.3	0	1	7	17	46	29	
			4.3-5.5	1	0	3	9	29	58	
			Mean	**1**	**0**	**5**	**12**	**37**	**45**	

SP 86 SW 638 **8282 6447** **Ecton** **Block D**

Surface level (+103.9 m) +341 ft
Groundwater conditions not recorded
203 mm percussion
November 1974

Overburden 2.1 m
Mineral 2.2 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
Boulder Clay	Clay, pebbly, sandy, soft, yellow-brown	0.8	1.5
	Clay, stiff, pale blue-grey, with calcareous root traces	0.6	2.1
Glacial Sand and Gravel	'Clayey' pebbly sand Gravel: fine, subangular to rounded, tabular, ironstone with vein quartz and quartzite Sand: fine to coarse, ironstone, quartz and quartzite	2.2	4.3
Northampton Sand	Sandstone, iron-rich, medium to coarse-grained	0.2+	4.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
				Fines	Sand			Gravel		
Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
15	73	12	2.1-3.1	10	34	35	6	9	6	
			3.1-4.3	18	33	32	8	8	1	
			Mean	**15**	**33**	**33**	**7**	**9**	**3**	

SP 86 SW 639 **8218 6234** **Great Billing** **Block A**

Surface level (+53.3 m) +175 ft
Water struck at (+51.1 m)
203 mm percussion
November 1974

Overburden 1.7 m
Mineral 3.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
Alluvium	Clay, sandy, with flint and quartz pebbles	0.5	1.7
River Gravel (First Terrace)	'Clayey' gravel Gravel: fine to coarse, angular flint and quartz, subrounded ironstone and sandstone Sand: subangular flint with shell fragments	3.5+	5.2
	Hole abandoned in rising gravel		

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
12	42	46	1.7-2.7	17	17	20	11	26	9	
			2.7-3.7	7	9	34	11	26	13	
			3.7-4.7	7	10	14	9	23	37	
			4.7-5.2	8	6	14	15	35	22	
			Mean	**12**	**9**	**22**	**11**	**26**	**20**	

SP 86 SW 640 **8251 6177** **Great Billing** **Block A**

Surface level (+50.3 m) +165 ft
Water struck at (+48.6 m)
203 mm percussion
May 1974

Overburden 1.4 m
Mineral 2.2 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Alluvium	Clay, sandy, with scattered fine and medium angular flint pebbles	1.0	1.4
River Gravel (First Terrace)	'Clayey' sandy gravel Gravel: fine to coarse, subangular to rounded flint with quartzite and ironstone Sand: medium, angular to subangular, flint and quartz with ironstone	2.2	3.6
Upper Lias	Clay, stiff, blue-grey	0.8+	4.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
14	54	32	1.4-2.4	16	14	28	14	23	5	
			2.4-3.6	12	11	27	14	18	18	
			Mean	14	**12**	**28**	**14**	**20**	**12**	

SP 86 SW 641 **8226 6094** **Cogenhoe** **Block D**

Surface level (+61.9 m) +203 ft
Water struck at (+58.8 m)
203 mm percussion
May 1974

Overburden 3.1 m
Mineral 0.9 m
Waste 10.4 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, chalky, with fine quartz sand and angular flint gravel	3.0	3.1
Glacial Sand and Gravel	'Very clayey' sand Gravel: fine, angular, flint Sand: fine, subangular, quartz and flint	0.9	4.0
Boulder Clay	Clay, chalky, stiff, dark grey	10.4	14.4
Upper Lias	Clay, stiff, blue	0.2+	14.6

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
36	62	2	3.1-4.0	36	58	3	1	2		

SP 86 SW 642 **8341 6273** **Great Billing** **Block A**

Surface level (+55.8 m) +183 ft
Water struck at (+52.9 m)
203 mm percussion
May 1974

Overburden 0.3 m
Mineral 2.5 m
Waste 0.6 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel (Second Terrace)	'Very clayey' pebbly sand Gravel: fine, subangular, flint and ironstone Sand: fine to medium, angular to well rounded, quartz and flint with ironstone	2.5	2.8
River Channel Infill	Clays and silts, laminated, with scattered pebbles near the top	0.6	3.4
Upper Lias	Clay, stiff, blue-grey	0.7+	4.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
33	51	16	0.3-1.5	39	23	17	7	11	3	
			1.5-2.5	24	28	21	8	14	5	
			2.5-2.8	No grading data available						
			Mean	**33**	**25**	**19**	**7**	**12**	**4**	

SP 86 SW 643 **8316 6250** **Great Billing** **Block A**

Surface level (+51.5 m) +169 ft
Water struck at (+49.7 m)
203 mm percussion
May 1974

Overburden 0.9 m
Mineral 1.2 m
Waste 1.0 m
Mineral 1.5 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Gravel (First Terrace)	**a** 'Very clayey' sandy gravel Gravel: fine to coarse, rounded, ironstone Sand: fine to medium, rounded, quartz with ironstone	1.2	2.1
	Clay, firm, brown with grey streaks, scattered angular ironstone pebbles	1.0	3.1
	b Gravel Gravel: fine to coarse, angular to rounded, flint and quartzite with quartz Sand: fine to medium, rounded to subangular, quartz and flint with ironstone	1.5	4.6
Upper Lias	Clay, stiff, blue-grey	0.3+	4.9

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
a	30	40	30	0.9-1.6	37	14	22	9	16	2	
				1.6-2.1	20	5	15	13	24	23	
				Mean	**30**	**10**	**19**	**11**	**19**	**11**	
b	3	38	59	3.1-4.6	3	3	19	16	31	28	
a+b	**15**	**39**	**46**	**Mean**	**15**	**6**	**19**	**14**	**26**	**20**	

COMPOSITION

Depth below surface (m)	Percentages by weight in gravel (+4 -16 mm) fraction						
	Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
a+b	79	13	trace	trace	8	0	trace

SP 86 SW 644 **8391 6253** **Great Billing** **Block A**

Surface level (+51.2 m) +168 ft
Water not struck
203 mm percussion
May 1974

Overburden 1.9 m
Mineral 1.2 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and subsoil	1.9	1.9
River Gravel (First Terrace)	'Clayey' sandy gravel Gravel: mainly fine, rounded, flint and quartzite Sand: medium, subangular to rounded, quartz and flint with ironstone	1.2	3.1
Upper Lias	Clay, stiff, brown, becoming blue-grey with depth	1.0+	4.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
12	45	43	1.9-3.1	12	9	17	19	29	14	

SP 86 SW 645 **8402 6198** **Great Billing** **Block A**

Surface level (+47.7 m) +157 ft
Water struck at (+46.4 m)
203 mm percussion
May 1974

Overburden 1.3 m
Mineral 2.3 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, firm, orange-brown, with fine sand and fine ironstone pebbles	1.0	1.3
River Gravel (First Terrace)	Gravel Gravel: fine to coarse, angular flint and subrounded ironstone Sand: fine to medium, well rounded flint and quartz	2.3	3.6
Upper Lias	Clay, stiff, blue-grey	0.2+	3.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
6	44	50	1,3-2.1	12	8	28	12	26	14	
			2.1-3.6	3	3	21	18	34	21	
			Mean	**6**	**5**	**23**	**16**	**31**	**19**	

SP 86 SW 646 **8323 6162** **Great Billing** **Block A**

Surface level (+49.4 m) +162 ft
Water struck at (+47.6 m)
203 mm percussion
May 1974

Overburden 1.2 m
Mineral 3.9 m
Bedrock 2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and subsoil	1.2	1.2
River Gravel (First Terrace)	Gravel Gravel: mainly fine, subangular and rounded, flint and quartzite with ironstone Sand: fine to coarse, subangular and rounded, flint, quartz and ironstone	3.9	5.1
Upper Lias	Clay, stiff, blue-grey	2.0+	7.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
9	42	49	1.2-2.2	21	6	20	17	25	11	
			2.2-3.2	11	1	18	19	34	17	
			3.2-4.2	2	2	15	27	39	16	
			4.2-5.1	2	3	17	21	36	21	
			Mean	**9**	**3**	**18**	**21**	**33**	**16**	

SP 86 SW 647 **8382 6126** **Cogenhoe** **Block A**

Surface level (+48.9 m) +160 ft
Water struck at (+46.4 m)
203 mm percussion
November 1974

Overburden 2.0 m
Mineral 2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.0	1.0
Alluvium	Clay, sandy, pebbly	1.0	2.0
River Gravel (First Terrace)	Pebbly sand Gravel: coarse, subangular to rounded, flint and sandstone with ironstone Sand: fine to coarse, subangular, quartz and flint with ironstone	2.0+	4.0
	Hole abandoned in rising gravel		

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	73	20	2.0-4.0	7	15	48	10	15	5	

SP 86 SW 648 **8466 6279** **Earls Barton** **Block A**

Surface level (+53.6 m) +176 ft
Water not struck
203 mm percussion
November 1974

Overburden 0.8 m
Mineral 2.0 m
Waste 1.4 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
River Gravel (First-Second Terrace)	'Very clayey' sandy gravel Gravel: fine to coarse, tabular, ironstone and quartz Sand: fine to coarse, subangular, quartz and ironstone	2.0	2.8
	Clay, pebbly, sandy	1.4	4.2
Upper Lias	Clay, blue-grey	1.3+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
21	43	36	0.8-1.8	23	15	18	13	21	10	
			1.8-2.8	20	14	14	12	31	9	
			Mean	**21**	**15**	**16**	**12**	**26**	**10**	

SP 86 SW 649 **8442 6114** **Cogenhoe** **Block A**

Surface level (+48.1 m) +158 ft
Water struck at (+46.0 m)
203 mm percussion
November 1974

Overburden 2.1 m
Mineral 1.8 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and subsoil	1.5	1.5
Alluvium	Clay, soft, blue-grey	0.6	2.1
River Gravel (First Terrace)	Gravel Gravel: fine to coarse, rounded to subangular, flint, ironstone and quartz. Some cobbles Sand: fine to coarse, flint, ironstone and quartz	1.8	3.9
Upper Lias	Clay, blue-grey	0.4+	4.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
2	28	70	2.1-3.1	1	1	10	14	36	38	
			3.1-3.9	3	2	14	15	36	30	
			Mean	**2**	**2**	**12**	**14**	**36**	**34**	

SP 86 SW 650 **8480 6079** **Whiston** **Block A**

Surface level (+49.4 m) +162 ft
Water struck at (+45.4 m)
203 mm percussion
November 1974

Waste 2.9 m
Bedrock 1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Alluvium	Clay, silty, with yellow sand lenses, pebbles and shell fragments	2.9	2.9
Upper Lias	Clay, stiff, blue-grey, weathered at top	1.6+	4.5

SP 86 SW 651 **8381 6439** **Earls Barton** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 5.5 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Alluvium	Clay, medium brown, sandy, with silt patches and carbonaceous material	1.6	1.6
	Clay, medium brown and red-brown, sandy, pebbly, with clasts of chalk, limestone, ironstone and flint	3.9	5.5
Upper Lias	Clay, stiff, blue-grey, silty	0.5+	6.0

SP 86 SE 46 **8552 6240** **Earls Barton** **Block A**

Surface level (+52.0) +171 ft
Groundwater conditions not recorded
152 mm percussion
May 1975

Overburden 6.2 m
Mineral 2.0 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.0	1.0
Alluvium	Clay, firm, orange-brown, with angular flint pebbles. Becoming sandy at depth	5.2	6.2
River Gravel (First Terrace)	'Clayey' gravel Gravel: fine to coarse, angular and subangular, ironstone and limestone with sandstone Sand: coarse, medium brown, ironstone, limestone, sandstone and flint	2.0	8.2
Middle Lias (Marlstone Rock Bed)	Detrital limestone	0.8+	9.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
19	29	52	6.2-7.2	17	8	14	12	10	39	
			7.2-8.2	21	7	8	10	16	38	
			Mean	**19**	**7**	**11**	**11**	**13**	**39**	

SP 86 SE 47 **8557 6158** **Grendon** **Block A**

Surface level (+47.7 m) +157 ft
Water struck at (+45.6 m)
152 mm percussion
July 1975

Overburden 2.1 m
Mineral 4.0 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.9	0.9
Alluvium	Clay, yellowish green, with angular flint pebbles	1.2	2.1
River Gravel (First Terrace)	Sandy gravel Gravel: fine to coarse, angular and subangular, flint and ironstone with limestone Sand: fine to coarse, flint and ironstone	4.0	6.1
Middle Lias (Marlstone Rock Bed)	Limestone, chamositic, oolitic, green	0.1+	6.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
10	45	45	2.1-3.1	9	4	12	14	38	23	
			3.1-5.1	11	5	14	27	23	20	
			5.1-6.1	8	7	39	24	17	5	
			Mean	**10**	**5**	**20**	**20**	**28**	**17**	

SP 86 SE 48 **8655 6456** **Great Doddington** **Block D**

Surface level (+102.1 m) +335 ft
Water not struck
203 mm percussion
October 1974

Waste 4.0 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, firm, chalky, with flint, rust brown, becoming grey with depth	3.7	4.0
Upper Estuarine 'Series'	Clay, stiff, dark blue-grey, with carbonaceous partings and calcareous band	0.6	4.6
	Clay, silty, soft, pale grey	0.1+	4.7

SP 86 SE 49 **8686 6329** **Earls Barton** **Block A**

Surface level (+49.2 m) +161 ft
Groundwater conditions not recorded
203 mm percussion
October 1974

Waste 3.0 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Alluvium	Clay, sandy, ironstained, with fine angular flint	2.4	3.0
Upper Lias	Clay, stiff, silty, medium brown	1.5+	4.5

SP 86 SE 50 **8622 6282** **Earls Barton** **Block A**

Surface level (+46.3 m) +152 ft
Water struck at (+44.0 m)
152 mm percussion
July 1975

Overburden 2.1 m
Mineral 2.3 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, sandy, with scattered angular flint pebbles	1.9	2.1
River Gravel (First Terrace)	'Clayey' sandy gravel Gravel: mainly fine, angular to rounded, ironstone and flint with quartzite and some limestone Sand: fine to medium, quartz, flint and ironstone	2.3	4.4
Upper Lias	Clay, silty, firm, grey, with thin siltstone seams	2.1+	6.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
12	45	43	2.1-4.4	12	5	24	16	28	15	

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction						
Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
52	30	6	0	12	0	0

SP 86 SE 51 **8681 6167** **Grendon** **Block A**

Surface level (+45.8 m) +150 ft
Water struck at (+43.5 m)
203 mm percussion
July 1974

Overburden 2.5 m
Mineral 2.4 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Alluvium	Clay, sandy, firm, medium brown, becoming blue and silty with depth	2.1	2.5
River Gravel (First Terrace)	Gravel Gravel: fine to coarse, subangular to rounded, quartz, quartzite, flint and ironstone	2.4	4.9
Upper Lias	Clay, firm, dark blue-grey	1.0+	5.9

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
6	40	54	2.5-4.9	6	5	16	19	32	22	

SP 86 SE 52 **8658 6113** **Grendon** **Block A**

Surface level (+47.2 m) +155 ft
Water not struck
203 mm percussuon
May 1974

Waste 1.2 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.2	1.2
Upper Lias	Clay, yellow-brown becoming blue-grey with depth	2.1+	3.3

SP 86 SE 54 **8703 6072** **Grendon** **Block D**

Surface level (+51.4 m) +169 ft
Water not struck
203 mm percussion
May 1974

Waste 1.1 m
Bedrock 1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, pale brown and ironstained	0.7	1.0
	Sand	0.1	1.1
Upper Lias	Clay, stiff, blue-grey	1.6+	2.7

SP 86 SE 55 **8896 6449** **Great Doddington** **Block A**

Surface level (+43.5 m) +143 ft
Water struck at (+42.1 m)
203 mm percussion
November 1974

Overburden 1.9 m
Mineral 2.1 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, sandy, silty, medium brown, ironstained	1.0	1.3
	Clay, very sandy, with silt partings, yellow brown	0.6	1.9
River Gravel (First Terrace)	Gravel Gravel: fine to coarse, subangular to rounded, ironstone with flint, limestone and some quartzite Sand: fine to medium, subangular, flint, quartz and ironstone	2.1	4.0
Upper Lias	Clay, firm, blue-grey	1.0+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	43	54	1.9-2.9	3	2	15	20	47	13	
			2.9-4.0	4	2	22	23	35	14	
			Mean	**3**	**2**	**19**	**22**	**41**	**13**	

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
55	24	15	trace	6	trace	trace

SP 86 SE 56 **8809 6380** **Great Doddington** **Block A**

Surface level (+42.5 m) +139 ft
Water struck at (+40.8 m)
203 mm percussion
November 1974

Overburden 1.7 m
Mineral 2.5 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, brown, sandy, with flint pebbles	0.4	0.7
	Clay, grey, with medium sand, damp	1.0	1.7
River Gravel (First Terrace)	Gravel Gravel: fine to medium, subangular to rounded, flint and quartzite Sand: fine to coarse, subangular, flint	2.5	4.2
Upper Lias	Clay, firm, blue-grey	0.8+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	46	49	1.7-3.0	3	2	27	16	24	28	
			3.0-4.2	6	4	24	19	31	16	
			Mean	**5**	**3**	**26**	**17**	**27**	**22**	

SP 86 SE 57 **8858 6297** **Wollaston** **Block A**

Surface level (+45.1 m) +148 ft
Water struck at (+43.8 m)
203 mm percussion
May 1974

Overburden 0.7 m
Mineral 2.1 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
River Gravel (First Terrace)	Sandy gravel Gravel: fine to coarse, subangular to rounded, flint and quartzite Sand: fine to medium, well rounded, quartz and flint with ironstone	2.1	2.8
Upper Lias	Clay, firm, blue-grey	0.4+	3.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	46	47	0.7-1.3	11	22	35	10	19	3	
			1.3-2.8	6	8	17	13	32	24	
			Mean	**7**	**12**	**22**	**12**	**29**	**18**	

SP 86 SE 58 **8977 6488** **Wollaston** **Block A**

Surface level (+41.0 m) +135 ft
Water struck at (+39.6 m)
203 mm percussion
October 1974

Overburden 1.4 m
Mineral 3.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, rust brown, friable	0.8	1.1
	Clay, very sandy, rust brown, with ironstone	0.3	1.4
River Gravel (First Terrace)	Gravel Gravel: fine to coarse, subangular to rounded, flint, quartz, quartzite and ironstone Sand: fine to medium with coarse, subangular, flint, quartz and ironstone	3.0+	4.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
				Fines	Sand			Gravel		
Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
1	38	61	1.4-2.4	2	4	25	20	31	18	
			2.4-3.4	1	6	9	16	50	18	
			3.4-4.4	1	2	13	18	41	25	
			Mean	**1**	**4**	**16**	**18**	**41**	**20**	

SP 86 SE 60 **8906 6372** **Wollaston** **Block A**

Surface level (+42.4 m) +139 ft
Water struck at (+41.5 m)
203 mm percussion
May 1974

Overburden 0.4 m
Mineral 1.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravel (First Terrace)	'Very clayey' sandy gravel Gravel: fine to coarse, subangular to rounded, flint and ironstone Sand: fine to medium, subangular, quartz and flint with ironstone	1.8	2.2
Upper Lias	Clay, stiff, medium grey	0.9+	3.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
				Fines	Sand			Gravel		
Fines	Sand	Gravel		$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
22	45	33	0.4-1.4	20	10	19	12	22	17	
			1.4-2.2	26	17	21	11	18	7	
			Mean	**22**	**13**	**20**	**12**	**20**	**13**	

SP 86 SE 61 **8966 6276** **Wollaston** **Block D**

Surface level (+58.5 m) +192 ft
Groundwater conditions not recorded
203 mm percussion
October 1974

Waste 5.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, firm, orange-brown, with chalk and flint pebbles and sand	0.9	1.3
	Clay, very sandy	1.3	2.6
	Clay, firm, medium grey, with chalk	2.4+	5.0

SP 86 SE 62 **8998 6272** **Wollaston** **Block D**

Surface level (+49.4 m) +162 ft
Water not struck
203 mm percussion
October 1974

Waste 1.2 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, brown, friable, becoming sandy with depth	0.6	0.9
	Sand, clayey, yellow	0.3	1.2
Upper Lias	Clay, firm, dark blue-grey	0.8+	2.0

SP 86 SE 63 **8936 6166** **Strixton** **Block D**

Surface level (+73.3 m) +240 ft
Water not struck
203 mm percussion
October 1974

Waste 2.3 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, silty, stiff, dark brown, with sand and flint and chalk fragments	2.2	2.3
Upper Estuarine 'Series'	Clay, silty, pale grey, with limestone fragments	0.2+	2.5

SP 86 SE 72 **8810 6090** **Grendon** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 6.0 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Made ground	Brickbats, pebbles etc	0.4	0.4
Alluvium	Clay, light greeenish grey, becoming brown with depth, scattered fine pebbles and shell fragments	1.4	1.8
	Obstruction: no recovery	0.4	2.2
	Clay, laminated, bluish grey with yellow silt partings. Contains sandy patches, plant material, calcite crystals and scattered fine pebbles	3.8	6.0
Upper Lias	Clay, stiff, blue-grey, with rare shell fragments and ferruginous nodules	0.1+	6.1

SP 86 SE 73 **8992 6069** **Grendon** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 3.0 m
Bedrock 1.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Alluvium	Clay, sandy, with scattered pebbles, firm and with shell fragments below 1.2 m	2.5	2.5
	Clay, firm to soft, grey, sandy, with hard seams	0.5	3.0
Upper Lias	Clay, firm, blue-grey	1.7+	4.7

SP 86 SE 74 **8621 6138** **Grendon** **Block A**

Surface level not recorded
Ground water conditions not recorded
76 mm powered auger
July 1978

Waste 2.6 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.0	1.0
Alluvium	Silt, clayey, sandy with coarse sand size flint chips. Becoming very clayey with depth	0.5	1.5
	Clay, firm to stiff, grey, green and brown, silty	1.1	2.6
Upper Lias	Clay, stiff, dark grey	1.4+	4.0

SP 86 SE 75 **8623 6143** **Grendon** **Block A**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Overburden 0.4 m
Mineral 2.1 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravel (First Terrace)	Sandy gravel Gravel: angular flint with subrounded ironstone and quartzite Sand: flint, ironstone and quartz	1.5	1.9
	'Clayey' pebbly sand	0.6	2.5
Upper Lias	Clay, stiff, dark blue-grey	0.5+	3.0
	No grading data available		

SP 87 NE 75 **8521 7760** **Cransley** **Block B**

Surface level (+65.7 m) +216 ft
Groundwater conditions not recorded
203 mm percussion
May 1975

Waste 4.3 m
Bedrock 1.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, soft, yellow-brown, sandy	1.1	1.4
	Clay, greenish grey, with pebbles	2.7	4.1
	Clay, dark grey-brown, organic, with scattered pebbles	0.2	4.3
Upper Lias	Clay, soft becoming firm with depth, grey	1.8+	6.1

SP 87 NE 76 **8516 7520** **Pytchley** **Block D**

Surface level (+108.0 m) +354 ft
Groundwater conditions not recorded
203 mm percussion
May 1975

Overburden 2.3 m
Mineral 5.3 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, firm, buff-brown, containing abundant chalk and with ironstone, flint, quartz and limestone fragments	2.2	2.3
Glacial Sand and Gravel	'Very clayey' sandy gravel Gravel: fine and coarse, angular to subrounded, flint, ironstone and limestone Sand: fine to coarse, subangular, flint, quartz and ironstone	5.3	7.6
Upper Estuarine 'Series'	Silts, firm, brown and black	1.2+	8.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
34	43	23	2.3-6.0	39	13	18	17	8	5	
			6.0-7.1	19	9	12	11	28	21	
			7.1-7.6	30	11	10	12	18	19	
			Mean	**34**	**12**	**16**	**15**	**13**	**10**	

SP 87 NE 77 **8648 7702** **Broughton** **Block B**

Surface level (+61.0 m) +200 ft
Groundwater conditions not recorded
152 mm percussion
June 1975

Overburden 2.4 m
Mineral 1.1 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Clay, soft to firm, yellow and red-brown, sandy, with scattered pebbles	2.3	2.4
River Gravel (Second Terrace)	Gravel Gravel: fine with coarse, subangular to subrounded, ironstone, limestone and quartzite Sand: coarse, subangular to subrounded, quartz and ironstone	1.1	3.5
Upper Lias	Clay, stiff, blue-grey	0.6+	4.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
8	42	50	2.4-3.5	8	5	9	28	37	13	

SP 87 NE 78 **8698 7645** **Kettering** **Block B**

Surface level (+59.1 m) +194 ft
Water struck at (+56.7 m)
203 mm percussion
August 1974

Overburden 1.6 m
Mineral 2.5 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Alluvium	Clay, glutinous, rust brown	1.1	1.6
River Gravel (Second Terrace)	'Clayey' gravel Gravel: fine with coarse, predominantly angular flint Sand: fine to coarse, mainly flint	2.5	4.1
Upper Lias	Clay, stiff, blue-grey	1.0+	5.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
19	40	41	1.6-2.6	24	9	14	15	29	9	
			2.6-4.1	16	10	15	15	23	21	
			Mean	**19**	**10**	**15**	**15**	**25**	**16**	

SP 87 NE 79 **8705 7612** **Pytchley** **Block B**

Surface level (+61.6 m) +202 ft
Water not struck
203 mm percussion
August 1974

Waste 2.8 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel (Second Terrace)	Clay, firm, orange-brown, sandy and becoming silty with depth	1.9	2.2
	Clay, orange-brown, sandy, pebbly	0.6	2.8
Upper Lias	Clay, firm, blue-grey	0.9+	3.7

SP 87 NE 80 **8879 7979** **Warkton** **Block B**

Surface level (+63.0) +208 ft
Groundwater conditions not recorded
152 mm percussion
June 1975

Waste 2.0 m
Bedrock 3.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, soft, red-brown becoming grey, sandy, containing gastropod shells	1.6	1.8
	Sandy gravel, becoming pebbly clay with depth	0.2	2.0
Upper Lias	Clay, firm, blue-grey	3.2+	5.2

SP 87 NE 81 **8825 7869** **Kettering** **Block B**

Surface level (+60.0 m) +197 ft
Water struck at (+58.5 m)
203 mm percussion
August 1974

Waste 3.1 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, glutinous, pale brown, becoming silty with depth	2.5	2.8
	Gravel, coarse, rounded, flint and quartzite	0.3	3.1
Upper Lias	Clay, firm, blue-grey	0.9+	4.0

SP 87 NE 82 **8838 7716** **Kettering** **Block B**

Surface level (+57.3 m) +188 ft
Water struck at (+54.6 m)
203 mm percussion
August 1974

Overburden 2.7 m
Mineral 1.6 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, firm, medium brown, silty	2.4	2.7
River Gravel (Second Terrace)	Gravel Gravel: mainly fine with coarse, subangular flint, rounded ironstone and quartzite Sand: mainly coarse, flint, ironstone and quartz	1.6	4.3
Upper Lias	Clay, firm, blue-grey	0.7+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
1	42	57	2.7-4.3	1	2	16	24	42	15	

SP 87 SE 2 **8908 7404** **Isham** **Block B**

Surface level (+52.3 m) +172 ft
Water not struck
152 mm percussion
September 1975

Waste 2.3 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, medium brown, sandy, with scattered pebbles and carbonaceous matter	1.8	2.0
	'Clayey' sandy gravel Gravel: mainly subrounded to rounded platy ironstone with rounded sandstone, subangular to subrounded limestone and angular flint Sand: quartz, ironstone and flint	0.3	2.3
Upper Lias	Clay, stiff, blue-grey	1.0+	3.3

SP 87 SE 3 **8971 7355** **Burton Latimer** **Block B**

Surface level (+50.9 m) +167 ft
Water struck at (+48.6 m)
152 mm percussion
September 1975

Overburden 0.3 m
Mineral 3.3 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
	Clay, firm, greenish grey	0.1	0.3
River Gravel (First Terrace)	'Clayey' sandy gravel Gravel: fine, subangular to subrounded ironstone and angular flint with some subrounded limestone Sand: fine to coarse, flint, quartz and ironstone	3.3	3.6
Upper Lias	Clay, stiff, blue-grey	1.2+	4.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
17	50	33	0.3-1.3	24	21	22	9	17	7	
			1.3-2.3	21	21	21	12	21	4	
			2.3-3.6	8	5	17	24	31	15	
			Mean	**17**	**15**	**19**	**16**	**24**	**9**	

SP 87 SE 4 **8966 7305** **Finedon** **Block B**

Surface level (+50.0 m) +164 ft
Water struck at (+48.8 m)
203 mm percussion
August 1974

Overburden 0.9 m
Mineral 3.2 m
Bedrock 1.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Gravel (First Terrace)	'Clayey' gravel Gravel: fine and coarse, subangular, flint and ironstone Sand: medium and coarse, subangular, flint, quartz and ironstone	3.2	4.1
Upper Lias	Clay, firm, blue-grey	1.9+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
14	42	44	0.9-4.1	14	7	15	20	23	21	

SP 87 SE 5 **8959 7189** **Little Harrowden** **Block B**

Surface level (+50.5 m) +166 ft
Groundwater conditions not recorded
152 mm percussion
September 1975

Overburden 0.5 m
Mineral 4.0 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
River Gravel (Second Terrace)	'Very clayey' sandy gravel Gravel: fine and coarse, ironstone and flint with with some quartzite Sand: mainly medium, ironstone and flint	4.0	4.5
Upper Lias	Clay, stiff, blue-grey	0.9+	5.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
25	45	30	0.5-3.5	23	20	17	11	15	14	
			3.5-4.5	31	8	14	13	25	9	
			Mean	**25**	**17**	**16**	**12**	**17**	**13**	

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
51	42	2	trace	5	0	0

SP 87 SE 6 **8997 7208** **Finedon** **Block B**

Surface level (+48.8 m) +160 ft
Water struck at (+47.6 m)
203 mm percussion
May 1975

Overburden 1.3 m
Mineral 1.8 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.3	1.3
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, angular and subangular flint and ironstone with rounded and subrounded limestone and quartzite Sand: mainly coarse, ironstone, quartz and flint	1.8	3.1
Upper Lias	Clay, stiff, blue-grey	0.6+	3.7

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
4	29	67	1.3-3.1	4	3	8	18	37	26	4

SP 87 SE 7 **8985 7112** **Great Harrowden** **Block B**

Surface level (+47.6 m) +156 ft
Groundwater conditions not recorded
203 mm percussion
December 1974

Waste 2.8 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
River Gravel (First Terrace)	Clay, sandy, with scattered pebbles	2.5	2.8
Upper Lias	Clay, stiff, blue-grey	0.7+	3.5

SP 87 NE 83 **8816 7623** **Kettering** **Block B**

Surface level (+56.7 m) +186 ft
Water struck at (+55.5 m)
203 mm percussion
August 1974

Waste 3.7 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Alluvium	Silt, medium to dark grey	3.3	3.7
Upper Lias	Clay, firm, blue-grey	0.3+	4.0

SP 87 NE 84 **8856 7507** **Kettering** **Block B**

Surface level (+50.6 m) +166 ft
Water struck at (+48.2 m)
203 mm percussion
August 1974

Overburden 2.3 m
Mineral 1.2 m
Bedrock 1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Alluvium	Clay, soft, pale brown, becoming firm and pale blue-grey with depth	1.9	2.3
River Gravel (First Terrace)	Gravel Gravel: fine and coarse with cobbles, subangular, flint and ironstone with quartzite and limestone Sand: mainly coarse, subangular to rounded, flint, quartz and ironstone	1.2	3.5
Upper Lias	Clay, firm, blue-grey	1.6+	5.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	30	67	2.3-3.5	3	3	8	19	27	29	11

SP 87 NE 85 **8534 7612** **Kettering** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 3.0 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Made ground		0.4	0.4
Alluvium	Clay, firm, brown and grey, with scattered flint pebbles and rare wood fragments. Thin gravel seam at the base	1.6	2.0
	Silt, unconsolidated, light yellow-brown	0.7	2.7
	Clay, light olive-brown, pebbly	0.3	3.0
Upper Lias	Clay, stiff, dark blue-grey	0.7+	3.7

SP 87 NE 86 **8542 7720** **Kettering** **Block B**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.9 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, medium brown, sandy, silty, with scattered pebbles	2.3	2.5
	'Very clayey' gravel Gravel: angular flint, subrounded ironstone and limestone Sand: quartz, ironstone and limestone	0.4	2.9
Upper Lias	Clay, stiff, blue-grey	0.7+	3.6

SP 87 SE 1 **8589 7258** **Orlingbury** **Block D**

Surface level (+108.8 m) +357 ft
Groundwater conditions not recorded
203 mm percussion
August 1974

Waste 8.1 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, firm, weathering to pale brown, containing abundant chalk and with limestone fragments near base	7.8	8.1
Blisworth Limestone	Limestone, oolitic	0.6+	8.7

SP 87 SE 20 **8945 7001** **Wellingborough** **Block D**

Surface level not recorded
Water not struck
76 mm powered auger
July 1978

Waste 1.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, brown, clayey	0.5	0.5
Alluvium	Silt, firm to stiff, light brown, clayey	1.0	1.5
Boulder Clay	Clay, chalky, containing fine quartzite clasts	0.3+	1.8

SP 87 SE 21 **8659 7148** **Little Harrowden** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.0 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, brown, clayey, silty	0.3	0.3
Alluvium	Clay, weathered, with coarse sand sized particles of chalk and ironstone	1.7	2.0
Upper Lias	Clay, stiff, blue-grey	0.8+	2.8

SP 87 SE 22 **8868 7310** **Isham** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 3.0 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, brown, clayey, silty, sandy	0.5	0.5
Alluvium	Clay, soft, brown, silty. Gravel seam between 2.2 m and 2.4 m, pebbly below 2.4 m	2.5	3.0
Upper Lias	Clay, stiff, blue-grey	1.0+	4.0

SP 96 SW 48 **9031 6306** **Wollaston** **Block D**

Surface level (+46.2 m) +152 ft
Water not struck
203 mm percussion
May 1975

Waste 1.6 m
Bedrock 3.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Alluvium	Clay, hard, yellow-grey, with sand lenses	0.7	1.2
	Sand, clayey, yellow-brown, with angular flint pebbles	0.4	1.6
Upper Lias	Clay, firm, blue-grey, with silt partings	3.2+	4.8

COMPOSITION

Percentages by weight in gravel (+4 -16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
39	30	27	trace	4	0	trace

SP 96 SW 49 **9093 6189** **Strixton** **Block D**

Surface level (+74.4 m) +244 ft
Water not struck
203 mm percussion
May 1974

Waste 6.0 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made ground	0.8	0.8
Boulder Clay	Clay, silty, with sand and isolated chalk fragments	5.2	6.0
?Upper Lias	Clay, firm, blue-grey	1.5+	7.5

SP 96 SW 50 **9030 6049** **Strixton** **Block D**

Surface level (+78.2 m) +257 ft
Water not struck
203 mm percussion
May 1975

Waste 10.4 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, stiff, dark grey weathering to buff yellow, with chalk fragments and angular flint pebbles	9.9	10.4
Blisworth Limestone	Limestone, oolitic, iron-rich	0.1+	10.5

SP 96 NW 151 **9083 6965** **Wellingborough** **Block B**

Surface level (+43.9 m) +144 ft
Water not struck
203 mm percussion
May 1974

Waste 2.9 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Clay, medium brown, sandy, pebbly in parts	0.6	0.7
	Clay, orange-brown, with fine sand	2.2	2.9
Upper Lias	Clay, firm, dark blue-grey	0.4+	3.3

SP 96 NW 152 **9071 6853** **Wellingborough** **Block B**

Surface level (+43.3 m) +142 ft
Water struck at (+42.1 m)
203 mm percussion
August 1974

Overburden 1.2 m
Mineral 3.6 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Alluvium	Clay, pale brown, silty	0.6	1.2
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, subangular, ironstone with limestone and flint Sand: medium and coarse, subangular, flint and quartz with ironstone	3.6	4.8
Upper Lias	Clay, firm, blue-grey	0.5+	5.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
1	41	58	1.2-2.2	2	4	13	17	35	29	
			2.2-3.2	1	3	16	29	44	7	
			3.2-4.8	1	2	15	24	32	26	
			Mean	**1**	**3**	**15**	**23**	**36**	**22**	

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
50	17	29	trace	4	0	trace

SP 96 NW 153 **9011 6751** **Wellingborough** **Block A**

Surface level (+43.0 m) +141 ft
Water struck at (+40.8 m)
203 mm percussion
May 1974

Overburden 2.2 m
Mineral 1.2 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and Made Ground	2.1	2.1
	Clay, dark, organic deposit	0.1	2.2
River Gravel (First Terrace)	'Very clayey' gravel Gravel: fine and coarse, subangular, flint, limestone, quartzite and ironstone Sand: medium, subangular, flint and ironstone	1.2	3.4
Upper Lias	Clay, stiff, weathered to yellowish grey, ironstained in parts	0.2+	3.6

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
22	25	53	2.2-3.4	22	4	13	8	27	26	

SP 96 NW 154 **9008 6720** **Wellingborough** **Block A**

Surface level (+41.5 m) +136 ft
Water struck at (+40.3 m)
203 mm percussion
May 1974

Overburden 1.0 m
Mineral 3.7 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
	Clay, pale orange-brown, sandy, with scattered angular flint and rounded ironstone pebbles	0.5	1.0
River Gravel (First Terrace)	Gravel Gravel: mainly fine, subangular and angular, ironstone and flint with limestone Sand: medium and coarse, angular to rounded, flint and ironstone	3.7	4.7
Upper Lias	Clay, firm, blue-grey	0.5+	5.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
8	43	49	1.0-2.0	16	10	21	16	30	7	
			2.0-3.0	10	8	22	14	29	17	
			3.0-4.0	4	2	17	20	42	15	
			4.0-4.7	2	3	13	22	43	17	
			Mean	**8**	**6**	**19**	**18**	**35**	**14**	

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction						
Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
34	41	14	5	6	0	trace

SP 96 NW 155 **9032 6688** **Wellingborough** **Block A**

Surface level (+40.2 m) +132 ft
Water struck at (+38.5 m)
203 mm percussion
May 1974

Overburden 1.7 m
Mineral 2.4 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, firm, medium brown, silty	0.5	0.7
	Clay, stiff, glutinous, brown with blue-grey patches	1.0	1.7
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, subangular, ironstone, flint and limestone with quartzite Sand: mainly medium, subangular to rounded, quartz, flint and ironstone	2.4	4.1
Upper Lias	Clay, stiff, blue-grey	0.2+	4.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
1	47	52	1.7-2.7	1	3	21	20	37	18	
			2.7-4.1	1	8	27	15	23	26	
			Mean	**1**	**6**	**24**	**17**	**29**	**23**	

SP 96 NW 156 **9012 6565** **Little Irchester** **Block A**

Surface level (+42.4 m) +139 ft
Water struck at (+40.9 m)
203 mm percussion
November 1974

Overburden 1.2 m
Mineral 2.7 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, soft, brown, sandy	0.9	1.2
River Gravel (First Terrace)	Sandy gravel Gravel: mainly fine, subangular to rounded, ironstone, flint and quartzite Sand: mainly medium, subangular, flint, quartz and ironstone	2.7	3.9
Upper Lias	Clay, firm, blue-grey	0.4+	4.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	54	43	1.2-1.5	No grading data available						
			1.5-2.5	4	8	44	13	20	11	
			2.5-3.0	1	2	14	17	46	20	
			3.0-3.9	2	3	36	16	28	15	
			Mean	**3**	**5**	**35**	**14**	**29**	**14**	

SP 96 NW 157 **9125 6728** **Wellingborough** **Block C**

Surface level (+40.8 m) +134 ft
Water struck at (+38.0 m)
203 mm percussion
July 1974

Overburden 2.8 m
Mineral 2.2 m
Bedrock 1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Alluvium	Clay, firm, brown, with sand at top	1.9	2.8
River Gravel (First Terrace)	Sandy gravel Gravel: mostly fine, subangular, flint and ironstone Sand: mainly coarse, subangular, flint and ironstone	2.2	5.0
Upper Lias	Clay, stiff, blue-grey	1.6+	6.6

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	50	47	2.8-3.8	3	4	19	28	32	14	
			3.8-5.0	3	3	19	26	33	16	
			Mean	**3**	**4**	**19**	**27**	**32**	**15**	

SP 96 NW 158 **9187 6819** **Wellingborough** **Block C**

Surface level (+41.5 m) +136 ft
Water struck at (+37.8 m)
203 mm percussion
November 1974

Overburden 3.7 m
MIneral 2.8 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Gravel (First Terrace)	Clay, rust brown, sandy, with some ironstone gravel	2.8	3.7
	Gravel Gravel: mainly fine, ironstone and flint with quartzite and some limestone and quartz Sand: coarse, subrounded, flint quartz and ironstone	2.8	6.5
Upper Lias	Clay, firm, blue-grey	1.5+	8.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
4	24	72	3.7-4.7	7	4	10	21	44	14	
			4.7-5.7	1	0	4	12	64	19	
			5.7-6.5	5	1	4	14	48	26	2
			Mean	**4**	**2**	**6**	**16**	**52**	**19**	**1**

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
52	30	4	5	9	0	trace

SP 96 NW 159 **9299 6823** **Irthlingborough** **Block C**

Surface level (+39.9 m) +131 ft
Water struck at (+36.9 m)
203 mm percussion
November 1974

Overburden 3.0 m
Mineral 3.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Made Ground	Clay, sandy, with rubble	1.4	1.5
Alluvium	Clay, dark grey, becoming brown at depth, sandy	1.0	2.5
	Silt, black, organic, with comminuted white gastropod shells	0.5	3.0

River Gravel (First Terrace)	Gravel Gravel: fine, angular to rounded ironstone and flint with quartzite, limestone and some quartz Sand: coarse with medium, subangular quartz and flint	3.0+	6.0
	Hole abandoned in rising gravel		

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
4	47	49	3.0-6.0	4	2	17	28	40	9	

SP 96 NW 160 **9211 6747** **Irchester** **Block C**

Surface level (+40.2 m) +132 ft
Water struck at (+38.2 m)
203 mm percussion
July 1974

Overburden 2.0 m
Mineral 2.1 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	2.0	2.0
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, subangular, flint and ironstone with quartz and quartzite and some limestone Sand: medium and coarse, flint, quartz and ironstone	2.1	4.1
Upper Lias	Clay, firm, blue-grey	1.0+	5.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
1	29	70	2.0-3.0	1	2	12	20	46	19	
			3.0-4.1	1	1	9	15	45	29	
			Mean	**1**	**2**	**10**	**17**	**46**	**24**	

SP 96 NW 163 **9429 6937** **Irthlingborough** **Block C**

Surface level (+46.0 m) +151 ft
Water not struck
203 mm percussion
July 1974

Overburden 2.6 m
Mineral 1.5 m
Waste 2.6 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
River Gravel (First Terrace)	Clay, stiff, medium brown, silty	1.8	2.6
	'Very clayey' sandy gravel Gravel: fine and coarse, subangular, ironstone Sand: mainly fine, subangular, quartz and flint	1.5	4.1

	Clay, pale brown, silty	2.6	6.7
Upper Lias	Clay, stiff, blue-grey	0.7+	7.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
28	47	25	2.6-4.1	28	20	14	13	15	10	

SP 96 NW 164 **9435 6784** **Rushden** **Block C**

Surface level (+40.0 m) +131 ft
Water struck at (+37.0 m)
203 mm percussion
November 1974

Overburden 4.0 m
Mineral 4.0 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Clay, rust brown, sandy, with some fine flint and quartz gravel	3.9	4.0
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, subangular, limestone with ironstone and flint Sand: medium and coarse, flint, quartz and ironstone	4.0	8.0
Upper Lias	Clay, firm, blue-grey	0.5+	8.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	43	52	4.0-5.0	4	5	18	20	21	18	14
			5.0-6.0	5	7	17	18	33	20	
			6.0-7.0	5	5	14	18	31	27	
			7.0-8.0	6	7	24	19	19	25	
			Mean	**5**	**6**	**18**	**19**	**26**	**23**	**3**

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
31	15	53	trace	1	trace	trace

SP 96 NW 185 **9430 6728** **Rushden** **Block D**

Surface level (+54.1 m) +178 ft
Groundwater conditions not recorded
203 mm percussion
May 1975

Waste 2.6 m
Bedrock 2.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
	Clay, soft, buff-brown	0.7	0.9
Peat	Clay, soft, dark brown to black, organic, sandy	1.2	2.1
	Clay, firm, dark grey, sandy	0.5	2.6
Upper Lias	Clay, firm, blue-grey	2.7+	5.3

SP 96 NW 186 **9449 6612** **Rushden** **Block D**

Surface level (+84.4 m) +227 ft
Groundwater conditions not recorded
152 mm percussion
September 1975

Waste 5.7 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, stiff, containing angular flint, subangular ironstone and fine rounded chalk fragments	5.5	5.7
Blisworth Clay	Clay, stiff, dark grey, with some shell debris	0.6+	6.3

SP 96 NW 187 **9358 6610** **Knuston** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.0 m
Bedrock 0.8 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, yellow-brown, sandy, with scattered pebbles	1.3	1.6
	Clay, glutinous, streaked yellow-brown and grey, with shell fragments and carbonaceous patches	0.4	2.0
Upper Lias	Clay, firm, medium grey, with ferruginous patches	0.8+	2.8

SP 96 NE 1 **9525 6986** **Higham Ferrers** **Block C**

Surface level (+35.5 m) +116 ft
Water struck at (+34.2 m)
152 mm percussion
July 1975

Overburden 1.3 m
Mineral 2.6 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, firm, mottled grey and brown, sandy in parts	1.0	1.3
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, angular to rounded, ironstone and flint with limestone and quartzite Sand: medium and coarse, subangular to rounded, sandstone, quartzite, flint and ironstone	2.6	3.9
Upper Lias	Clay, stiff, blue-grey, with shell debris	1.5+	5.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	41	54	1.3-2.3	6	3	11	26	41	13	
			2.3-3.9	4	4	18	20	23	31	
			Mean	**5**	**3**	**16**	**22**	**30**	**24**	

COMPOSITION

Percentages by weight in gravel (+4-16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
31	33	21	1	14	0	trace

SP 96 NE 3 **9606 6765** **Rushden** **Block D**

Surface level (+63.6 m) +209 ft
Water struck at (+56.6 m)
152 mm percussion
September 1975

Overburden 1.3 m
Mineral 8.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, firm, brown and grey; pebbles of flint, sandstone and chalk	1.3	1.3
Glacial Sand and Gravel	'Clayey' pebbly sand Gravel: mainly fine, angular to subrounded, flint, ironstone and limestone with quartzite Sand: fine to coarse, flint and ironstone	8.7+	10.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
11	68	21	1.3-2.3	13	20	47	14	6		
			2.3-3.3	19	36	28	8	8	1	
			3.3-4.3	15	12	37	21	13	2	
			4.3-5.3	10	13	41	18	16	2	
			5.3-6.3	7	11	48	11	18	5	
			6.3-7.3	8	17	40	14	18	3	
			7.3-9.0	10	9	27	22	19	13	
			9.0-10.0	6	5	27	20	27	15	
			Mean	**11**	**15**	**36**	**17**	**15**	**6**	

SP 96 NE 4 **9746 6885** **Higham Ferrers** **Block D**

Surface level (+74.2 m) +243 ft
Water not struck
152 mm percussion
June 1975

Waste 1.6 m
Bedrock 3.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Boulder Clay	Clay, firm, sandy, pebbly; pebbles of chalk and flint	1.5	1.6
Kellaways Sand	Clays, variegated, with fine sand partings and calcareous seams	3.1+	4.7

SP 96 NE 5 **9815 6811** **Higham Ferrers** **Block D**

Surface level (+71.5 m) +235 ft
Water not struck
152 mm percussion
June 1975

Overburden 1.4 m
Mineral 3.3 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Boulder Clay	Clay, medium brown, sandy, pebbly; pebbles of flint, quartz and chalk	1.2	1.4
Glacial Sand and Gravel	'Clayey' pebbly sand Gravel: fine, angular to rounded, limestone, sandstone, ironstone and flint Sand: medium with coarse, flint, ironstone and sandstone	3.3	4.7
Kellaways Sand	Clay, streaked greenish yellow, with fine sand	0.5+	5.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
15	74	11	1.4-2.4	17	13	59	6	5		
			2.4-4.0	14	18	45	8	13	2	
			4.0-4.7	No grading data available						
			Mean	**15**	**16**	**51**	**7**	**10**	**1**	

SP 96 NE 6 **9894 6892** **Chelveston cum Caldecott** **Block D**

Surface level (+68.4 m) +225 ft
Water not struck
152 mm percussion
June 1975

Overburden 1.2 m
Mineral 2.5 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.2	1.2
Glacial Sand and Gravel	'Clayey' sand Sand: medium and coarse, orange-brown	2.5	3.7
Kellaways Sand	Clay, firm, dark grey, with sand partings and scattered sandstone pebbles	1.0+	4.7

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
14	84	2	1.2-2.2	19	56	18	3	3	1	
			2.2-3.5	10	34	54	1	1		
			3.5-3.7	No grading data available						
			Mean	**14**	**43**	**39**	**2**	**1**	**1**	

SP 96 NE 20 **9704 6978** **Higham Ferrers** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.5 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Alluvium	Clay, yellow-brown, sandy, with scattered fine pebbles and shell fragments	1.8	2.3
	Sand, fine, greenish grey	0.2	2.5
Upper Lias	Clay, firm, blue-grey, with sandy ferruginous patches, shell fragments and race	1.5+	4.0

SP 87 SE 23 **8602 7368** **Pytchley** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.8 m
?Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Alluvium	Clay, brown becoming greenish grey with depth, sandy, with scattered pebbles below 1.3 m	2.3	2.8
?Lower Estuarine 'Series'	Fine sand, silt and clay, blue-grey, pebbly, with peat patches	0.7+	3.5

SP 87 SE 24 **8808 7467** **Isham** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.7 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, brown, with streaks of grey near the top, sandy, with shell fragments and fine pebbles	2.0	2.3
	Clay, glutinous, grey-green, very sandy in patches, silty	0.4	2.7
Upper Lias	Clay, firm to stiff, medium grey with yellow-brown silt partings	0.3+	3.0

SP 87 SE 25 **8930 7149** **Great Harrowden** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 1.7 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Alluvium	Clay, medium red-brown becoming red with depth, silty, with scattered fine pebbles	1.7	1.7
Upper Lias	Clay, firm, light grey, with scattered ironstone nodules and calcite crystals	1.2+	2.9

SP 96 SW 51 **9127 6320** **Wollaston** **Block D**

Surface level (+91.4 m) +300 ft
Water not struck
203 mm percussion
May 1974

Overburden 3.1 m
Mineral 1.3 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, firm, sandy, pebbly, medium brown; pebbles of chalk and flint	2.7	3.1
Glacial Sand and Gravel	'Very clayey' sandy gravel Gravel: fine, subangular to rounded, flint Sand: fine quartz with medium ironstone	1.3	4.4
Blisworth Limestone	Limestone, hard, oolitic	0.7+	5.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
30	47	23	3.1-4.1	39	17	17	8	14	5	
			4.1-4.4	0	23	27	14	21	15	
			Mean	**30**	**19**	**19**	**9**	**15**	**8**	

SP 96 SW 52 **9194 6118** **Strixton** **Block D**

Surface level (+94.5 m) +310 ft
Water not struck
203 mm percussion
May 1974

Waste 6.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.5	0.5
Boulder Clay	Clay, dark grey weathering khaki-brown, containing pebbles of chalk	5.4	5.9
	Clay, stiff, grey	0.2+	6.1

SP 96 SW 53 **9283 6472** **Irchester** **Block D**

Surface level (+89.3 m) +293 ft
Water not struck
203 mm percussion
May 1975

Overburden 0.2 m
Mineral 0.7 m
Waste 5.4 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Glacial Sand and Gravel	'Very clayey' sand, medium brown, pebbly, angular flint and subrounded to rounded chalk	0.7	0.9
Boulder Clay	Clay, yellow-brown, sandy, with flint and chalk pebbles	5.4	6.3
Blisworth Limestone	Limestone, oolitic, grey	0.2+	6.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
40	54	6	0.2-0.9	40	22	24	8	4	2	

SP 96 SW 54 **9205 6388** **Farndish** **Block D**

Surface level (+97.5 m) +320 ft
Water not struck
203 mm percussion
May 1975

Waste 10.0 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.8	0.8
Boulder Clay	Clay, stiff, pebbly, with pebbles of flint and sandstone, and sand partings, sand largely chalk particles	1.0	1.8
	Clay, pebbly, sandy, yellow, with chalk fragments	1.0	2.8
	Clay, stiff, yellowish grey; pebbles of flint and sandstone with chalk	7.2	10.0
Cornbrash ?	Hard rock. No recovery	0.1+	10.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
64	30	6	1.8-2.8	64	22	4	4	5	1	

SP 96 SW 55 **9226 6265** **Wollaston** **Block D**

Surface level (+90.9 m) +298 ft
Water not struck
203 mm percussion
May 1975

Waste 13.3 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made Ground	0.5	0.5
Boulder Clay	Clay, stiff, dark grey weathering to brown; pebbles of flint, chalk and sandstone	12.8	13.3
Blisworth Limestone	Limestone, oolitic, buff-yellow, ironstained, sandy	0.1+	13.4

SP 96 SW 56 **9327 6418** **Farndish** **Block D**

Surface level (+57.3 m) +188 ft
Water not struck
203 mm percussion
July 1974

Waste 2.3 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, firm, sandy	2.0	2.3
Upper Lias	Clay, firm, blue-grey	1.1+	3.4

SP 96 SW 57 **9399 6414** **Farndish** **Block D**

Surface level +69.7 m (+229 ft)
Water not struck
203 mm percussion
July 1974

Overburden 2.7 m
Mineral 2.5 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.1	1.1
	Clay, very sandy	1.6	2.7
Glacial Sand and Gravel	'Clayey' pebbly sand Gravel: fine, rounded, tabular, ironstone and flint with limestone Sand: fine to medium, subangular, flint, quartz, ironstone and limestone	2.5	5.2
Blisworth Limestone	Limestone, hard, oolitic	0.1+	5.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
14	69	17	2.7-4.0	15	17	39	15	13	1	
			4.0-5.2	14	15	32	19	17	3	
			Mean	14	16	36	17	15	2	

SP 96 SW 58 **9340 6259** **Podington** **Block D**

Surface level (+70.3 m) +231 ft
Water struck at (+65.7 m)
203 mm percussion
July 1974

Overburden 2.5 m
Mineral 7.7 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, firm, rust brown, sandy	2.1	2.5
Glacial Sand and Gravel	Sandy gravel Gravel: fine with coarse, subrounded ironstone and limestone and angular flint Sand: mainly medium, subangular, flint and ironstone	7.7	10.2
Lower Estuarine 'Series'	Clay, firm, dark blue, silty, micaceous	1.0+	11.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	66	27	2.4-4.5	13	7	42	17	20	1	
			4.5-6.5	6	15	59	8	10	2	
			6.5-8.5	4	7	27	19	31	12	
			8.5-10.2	3	5	31	27	28	6	
			Mean	**7**	**8**	**40**	**18**	**22**	**5**	

SP 96 SW 59 **9471 6492** **Wymington** **Block D**

Surface level (+62.4 m) +205 ft
Water not struck
203 mm percussion
July 1974

Overburden 3.0 m
Mineral 1.4 m
Waste 2.7 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
	Clay, firm, medium brown, silty	2.7	3.0

Glacial Sand and Gravel	Sandy gravel Gravel: fine, angular to rounded, quartzite, flint and limestone with ironstone Sand: fine to coarse, angular and subangular, quartz, flint and ironstone	1.4	4.4
Boulder Clay	Clay, firm, grey, pebbly	2.7	7.1
Upper Lias	Clay, firm, blue-grey	0.9+	8.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
7	66	27	3.0–4.4	7	14	36	16	23	4	

SP 96 SW 60 **9367 6268** **Podington** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm percussion
July 1978

Overburden 5.0
?Mineral 1.7 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Alluvium	Clay, medium brown, silty, with scattered pebbles and some plant material	1.2	2.0
	Silt, soft, grey-brown	3.0	5.0
Glacial Sand and Gravel	Sand, fine, silty brown	1.7	6.7
Upper Lias	Clay, dark blue-grey	1.3+	8.0

SP 96 SW 61 **9406 6356** **Podington** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.6 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.6	0.6
Boulder Clay	Clay, firm, brown and grey, with pebbles and rare shell fragments	1.3	1.9
	Clay, dark yellow-brown, sandy, with pebbles	0.2	2.1
	Clay, dark blue-grey variegated, pebbles of flint, limestone and quartzite	0.5	2.6
Upper Lias	Clay, stiff, blue-grey, with iron nodules, white calcite crystals and shell fragments	1.4+	4.0

SP 96 SW 62 **9491 6428** **Wymington** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Overburden 2.6 m
Mineral 1.4 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil, dark brown, clayey, sandy	1.4	1.4
Boulder Clay	Clay, sandy, pebbly	0.1	1.5
	Clay, stiff, grey and brown, with pebbles	1.1	2.6
Glacial Sand and Gravel	'Very clayey' pebbly sand Gravel: flint, ironstone and chalk	1.4	4.0
?Upper Lias	Clay, stiff, blue-grey	1.2+	5.2

SP 96 SW 63 **9477 6426** **Wymington** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Overburden 1.5 m
Mineral 0.8 m
Waste 2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil and made ground	0.5	0.5
Boulder Clay	Clay, firm to stiff, sandy, pebbly, becoming very sandy with depth	1.0	1.5
Glacial Sand and Gravel	'Very clayey' sand with scattered pebbles	0.8	2.3
Boulder Clay	Clay, stiff, grey-brown, pebbly, interbedded with pebble-free seams containing shell fragments and race	2.0+	4.3

SP 97 NW 305 **9382 7673** **Cranford** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 4.7 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Alluvium	Clay, light to medium brown, silty, with rare pebbles	1.7	1.7
	Clay, soft, glutinous, medium grey becoming greenish grey	3.0	4.7
Upper Lias	Clay, firm, bluish grey	1.3+	6.0

SP 97 NE 151 **9545 7514** **Great Addington** **Block D**

Surface level (+69.2 m) +227 ft
Water not struck
152 mm percussion
June 1975

Waste 8.4 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, firm, streaked blue-grey and grey-brown, with pebbles of ironstone, limestone and flint and some secondary calcite	6.6	7.0
Glacial Sand and Gravel	Sand, medium orange-brown, clayey, with scattered pebbles	1.4	8.4
Oxford Clay	Clay, firm, dark blue-grey	0.6+	9.0

SP 97 NE 152 **9667 7809** **Woodford** **Block D**

Surface level (+37.8 m) +124 ft
Water not struck
203 mm percussion
August 1974

Waste 1.9 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, glutinous, pale brown, silty with some sand and pebbles at base	1.7	1.9
Upper Lias	Clay, stiff, blue-grey	0.6+	7.5

SP 97 NE 153 **9695 7603** **Woodford** **Block D**

Surface level (+31.4 m) +103 ft
Water struck at (+30.0 m)
203 mm percussion
August 1974

Overburden 1.4 m
Mineral 2.2 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, glutinous, pale yellow-brown, slightly silty	1.1	1.4
River Gravel (First Terrace)	Gravel Gravel: fine with medium, subangular to rounded, ironstone, flint, limestone and quartzite Sand: medium and coarse, subangular, flint, ironstone and quartz	2.2	3.6
Upper Lias	Clay, firm, dark blue-grey	0.4+	4.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
2	47	51	1.4-2.4	3	6	19	20	34	18	
			2.4-3.6	1	5	24	20	35	15	
			Mean	**2**	**5**	**22**	**20**	**35**	**16**	

SP 97 NE 154 9726 7659 Ringstead Block C

Surface level (+30.8 m) +101 ft
Water struck at (+30.3 m)
203 mm percussion
May 1975

Overburden 0.9 m
Mineral 2.2 m
Bedrock 2.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Alluvium	Clay, yellow-brown with pale grey mottling, containing some plant remains	0.8	0.9
River Gravel (First Terrace)	Gravel Gravel: fine with coarse, subangular to subrounded, flint with quartzite and limestone Sand: medium and coarse, flint, ironstone and quartz	2.2	3.1
Upper Lias	Clay, firm, brown-grey, becoming blue-grey with depth	2.5+	5.6

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
6	45	49	0.9-2.0	8	3	25	24	35	5	
			2.0-3.1	4	4	16	18	30	28	
			Mean	**6**	**4**	**20**	**21**	**33**	**16**	

SP 97 NE 155 9765 7558 Woodford Block C

Surface level (+31.5 m) +103 ft
Water struck at (+30.0 m)
203 mm percussion
May 1975

Overburden 0.4 m
Mineral 4.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
River Gravel (First Terrace)	Sandy gravel Gravel: mainly fine, angular to subrounded, ironstone, flint, limestone and quartzite Sand: medium and coarse, flint, quartz and ironstone	4.0+	4.4
	Hole abandoned in rising gravel		

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
9	53	38	0.5-1.5	15	10	36	10	23	6	
			1.5-2.4	10	7	32	20	28	3	
			2.4-4.0	7	5	19	21	35	7	5
			4.0-4.4	1	2	20	42	32	3	
			Mean	**9**	**6**	**27**	**20**	**31**	**5**	**2**

SP 97 NE 156 **9842 7986** **Islip** **Block D**

Surface level (+33.1 m) +109 ft
Groundwater conditions not recorded
203 mm percussion
November 1974

Waste 5.1 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.4	1.4
Alluvium	Clay, soft, yellow-brown, containing fine pebbles, shell debris and peat	0.9	2.3
	Clay, soft, dark blue-grey, organic, becoming pebbly with depth	2.8	5.1
Upper Lias	Clay, stiff, dark blue-grey	0.9+	6.0

SP 97 NE 157 **9874 7802** **Islip** **Block C**

Surface level (+31.9 m) +105 ft
Groundwater conditions not recorded
203 mm percussion
May 1975

Overburden 0.8 m
Mineral 1.6 m
Waste 1.6 m
Bedrock 1.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
River Gravel (First Terrace)	'Clayey' gravel Gravel: fine and coarse, angular to subrounded, ironstone, limestone and flint Sand: fine to coarse, flint, quartz and ironstone	1.6	2.4

	Clay, grey, with sand and silt partings and scattered pebbles	1.6	4.0
Upper Lias	Clay, firm, dark blue-grey	1.5+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
14	38	48	0.8-1.6	21	23	18	12	18	8	
			1.6-2.4	6	5	10	8	27	44	
			Mean	**14**	**14**	**14**	**10**	**22**	**26**	

COMPOSITION

Depth below surface (m)	Percentages by weight in gravel (+4 -16 mm) fraction						
	Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
	40	26	32	trace	2	trace	trace

SP 97 NE 158 **9845 7670** **Woodford** **Block C**

Surface level (+31.0 m) +102 ft
Water struck at (+29.7 m)
152 mm percussion
July 1975

Overburden 1.5 m
Mineral 4.3 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, firm, brown, sandy, containing scattered pebbles and rootlets	1.1	1.3
	Clay, very pebbly, sandy	0.2	1.5
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, angular to rounded, ironstone with flint, limestone and some quartzite Sand: medium and coarse, flint and ironstone	4.3	5.8
Upper Lias	Clay, firm, dark blue-grey	0.6+	6.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
8	38	54	1.5-2.5	8	4	18	14	33	23	
			2.5-3.5	9	4	15	21	32	19	
			3.5-5.8	7	6	15	17	33	22	
			Mean	**8**	**5**	**16**	**17**	**33**	**21**	

COMPOSITION

Percentages by weight in gravel (+4 -16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
53	24	20	trace	3	trace	trace

SP 97 NE 159 **9928 7958** **Islip** **Block C**

Surface level (+27.8 m) +91 ft
Water struck at (+25.7 m)
203 mm percussion
August 1974

Overburden 1.1 m
Mineral 4.9 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.0	1.0
Alluvium	Clay, sandy, silty, ironstained	0.1	1.1
River Gravel (First Terrace)	Sandy gravel Gravel: mainly fine, subangular, ironstone, flint and limestone Sand: mainly medium, subangular, flint, quartz and ironstone	4.9	6.0
Upper Lias	Clay, firm, blue-grey	0.4+	6.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	72	25	1.1-2.1	7	12	46	11	20	4	
			2.1-3.1	2	8	48	19	17	6	
			3.1-4.1	2	10	59	7	16	6	
			4.1-5.1	2	11	56	9	19	3	
			5.1-6.0	2	10	47	11	25	5	
			Mean	**3**	**10**	**51**	**11**	**20**	**5**	

COMPOSITION

Percentages by weight in gravel (+4 -16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
31	30	31	trace	3	0	5

SP 97 NE 160 **9917 7831** **Thrapston** **Block C**

Surface level (+31.2 m) +102 ft
Groundwater conditions not recorded
152 mm percussion
May 1975

Overburden 4.1 m
Mineral 3.0 m
Waste 1.4 m
Bedrock 0.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	4.1	4.1
River Gravel (First Terrace)	Gravel Gravel: mainly coarse, angular to subrounded, flint, limestone and ironstone Sand: mainly coarse, quartz with flint and ironstone	3.0	7.1
	Clay, firm, blue-grey, with silt patches	1.4	8.5
Upper Lias	Clay, firm, blue-grey, containing fossils	0.2+	8.7

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	41	56	4.1-5.1	4	3	25	21	35	12	
			5.1-7.1	2	1	11	26	45	15	
			Mean	**3**	**1**	**16**	**24**	**42**	**14**	

SP 97 NE 161 **9904 7766** **Thrapston** **Block C**

Surface level (+30.2 m) +99 ft
Water struck at (+28.2 m)
203 mm percussion
August 1974

Overburden 2.1 m
Mineral 1.9 m
Bedrock 0.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Alluvium	Clay, firm, sandy, pebbly	1.3	2.1
River Gravel (First Terrace)	'Very clayey' sandy gravel Gravel: fine, ironstone, flint, limestone and quartzite Sand: fine to coarse, quartz, flint and ironstone	1.9	4.0
Upper Lias	Clay, firm, blue-grey	0.3+	4.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
23	56	21	2.1-3.0	33	21	30	6	9	1	
			3.0-4.0	15	9	28	18	29	1	
			Mean	**23**	**15**	**29**	**12**	**20**	**1**	

SP 97 NE 162 **9889 7694** **Denford** **Block C**

Surface level (+30.6 m) +100 ft
Water struck at (+29.6 m)
152 mm percussion
July 1975

Overburden 1.0 m
Mineral 2.9 m
Bedrock 1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
	Clay, brown, sandy, pebbly	0.8	1.0
River Gravel (First Terrace)	Sandy gravel Gravel: mainly fine, angular to rounded, flint, ironstone, limestone and quartzite Sand: medium and coarse, flint, ironstone and quartz	2.9	3.9
Upper Lias	Clay, stiff, blue-grey	1.6+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
8	54	38	1.0-2.0	9	7	18	20	37	9	
			2.0-3.9	7	6	30	23	25	9	
			Mean	**8**	**6**	**26**	**22**	**29**	**9**	

SP 97 NE 163 **9967 7603** **Denford** **Block D**

Surface level (+65.8 m) +216 ft
Water not struck
203 mm percussion
December 1974

Waste 7.7 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	0.8	0.8
Boulder Clay	Clay, stiff, blue-grey, containing pebbles of chalk, flint, limestone and ironstone	5.3	6.1
Glacial Sand and Gravel	Sandy gravel Gravel: fine, angular to rounded, flint, ironstone, limestone and quartzite Sand: medium with coarse, quartz, flint and ironstone	1.6	7.7
?Cornbrash	Limestone, hard, cream to pale grey	0.1+	7.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	70	27	6.1-7.7	3	6	44	20	25	2	

SP 97 NE 164 **9913 7564** **Ringstead** **Block D**

Surface level (+60.7 m) +199 ft
Water not struck
203 mm percussion
August 1974

Waste 2.1 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
Boulder Clay	Clay, stiff, yellowish brown, sandy	1.2	2.1
Blisworth Limestone	Limestone, soft and weathered, becoming hard	0.9+	3.0

SP 97 SW 273 **9009 7217** **Finedon** **Block B**

Surface level (+50.5 m) +166 ft
Water struck at (+48.2 m)
203 mm percussion
December 1974

Waste 3.7 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
River Gravel (First Terrace)	Clay, sandy, pebbles of flint and quartzite	3.5	3.7
Upper Lias	Clay, stiff, blue-grey	1.3+	5.0

SP 97 SW 274 **9042 7103** **Finedon** **Block B**

Surface level (+46.9 m) +154 ft
Water struck at (+45.8 m)
203 mm percussion
July 1974

Overburden 0.7 m
Mineral 2.1 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.7	0.7
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, subangular, flint, ironstone and limestone Sand: mainly coarse, flint and limestone	2.1	2.8
Upper Lias	Clay, firm, blue-grey	1.1+	3.9

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	44	51	0.7-2.8	5	6	15	23	32	19	

SP 97 SW 275 **9032 7051** **Finedon** **Block B**

Surface level (+43.9 m) +144 ft
Water struck at (+42.3 m)
203 mm percussion
July 1974

Overburden 1.6 m
Mineral 1.9 m
Bedrock 1.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.6	1.6
River Gravel (First Terrace)	Gravel Gravel: mainly fine, subangular to rounded, flint, limestone and ironstone, with quartzite cobbles Sand: mainly coarse, ironstone and flint	1.9	3.5
Upper Lias	Clay, stiff, blue-grey	1.1+	4.6

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
2	46	52	1.6-2.6	1	3	17	24	41	14	
			2.6-3.5	2	3	21	25	26	4	19
			Mean	**2**	**3**	**19**	**24**	**34**	**9**	**9**

SP 97 SW 276 **9468 7428** **Great Addington** **Block D**

Surface level (+78.7 m) +258 ft
Water not struck
203 mm percussion
May 1975

Waste 12.0 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, soft becoming firm, yellow-brown becoming dark grey, sandy, containing abundant chalk fragments and scattered pebbles of sandstone and limestone	11.7	12.0
Kellaways Clay	Clay, stiff, dark grey, containing belemnites	0.1+	12.1

SP 97 SW 277 **9492 7030** **Irthlingborough** **Block C**

Surface level (+36.3 m) +119 ft
Water struck at (+33.3 m)
203 mm percussion
July 1974

Waste 3.4 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, glutinous, medium brown, becoming blue-grey with depth, silty	2.7	3.0
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, angular to rounded, flint with ironstone and quartzite Sand: quartz, ironstone and flint	0.4	3.4
Upper Lias	Clay, stiff, blue-grey	1.0+	4.4

SP 97 SE 102 **9571 7417** **Little Addington** **Block D**

Surface level (+62.5 m) +205 ft
Water not struck
152 mm percussion
September 1975

Waste 3.3 m
Bedrock 2.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
Boulder Clay	Clay, greenish yellow and orange-brown, containing fragments of chalk, flint and sandstone	3.3	3.3
Oxford Clay	Clay, stiff, blue-grey, containing shell debris	2.7+	6.0

SP 97 SE 103 **9581 7047** **Irthlingborough** **Block C**

Surface level (+35.7 m) +117 ft
Water struck at (+34.8 m) +114 ft
203 mm percussion
July 1974

Overburden 0.9 m
Mineral 3.6 m
Bedrock 1.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Gravel (First Terrace)	Sandy gravel Gravel: fine, subangular to rounded, flint, ironstone, limestone and quartzite Sand: mainly medium with coarse, subangular, flint, quartz and ironstone	3.6	4.5
Upper Lias	Clay, firm, blue-grey	1.0+	5.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	50	43	0.9-2.9	11	12	27	12	29	9	
			2.9-4.5	2	5	23	20	40	10	
			Mean	**7**	**9**	**25**	**16**	**34**	**9**	

SP 97 SE 104 **9679 7483** **Great Addington** **Block C**

Surface level (+32.1 m) +105 ft
Water struck at (+30.7 m)
152 mm percussion
July 1975

Overburden 1.4 m
Mineral 2.4 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
	Clay, firm, mottled brown and grey, sandy, with scattered pebbles	1.2	1.4
River Gravel (First Terrace)	Gravel Gravel: fine with coarse, angular to rounded, flint, ironstone, quartzite and limestone Sand: mainly coarse, ironstone with flint	2.4	3.8
Upper Lias	Clay, stiff, dark blue-grey	1.2+	5.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	48	47	1.4-3.4	5	4	18	26	33	14	

SP 97 SE 105 **9647 7403** **Little Addington** **Block C**

Surface level (+35.1 m) +115 ft
Water struck at (+34.8 m)
203 mm percussion
November 1974

Overburden 2.7 m
Mineral 3.8 m
Bedrock 0.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Loam, yellowish grey, pebbly	1.3	1.6
	Clay, pebbly	1.1	2.7

River Gravel (First Terrace)	Gravel Gravel: fine with coarse, angular and subangular, limestone, sandstone, ironstone and flint Sand: coarse with medium, quartz and ironstone with limestone	3.8	6.5
Upper Lias	Clay, stiff, blue-grey	0.5+	7.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
2	31	67	2.7-3.7	2	2	8	13	47	28	
			3.7-4.7	2	3	10	19	43	23	
			4.7-6.5	3	4	11	23	48	11	
			Mean	**2**	**3**	**10**	**18**	**46**	**21**	

SP 97 SE 106 **9680 7399** **Little Addington** **Block C**

Surface level (+32.7 m) +107 ft
Water struck at (+30.7 m)
152 mm percussion
July 1975

Overburden 2.0 m
Mineral 1.9 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, firm, brown, sandy	0.7	0.9
	Clay, firm, grey, silty	1.1	2.0
River Gravel (First Terrace)	Sandy gravel Gravel: fine, angular to rounded, ironstone and limestone with flint and some quartzite Sand: mainly coarse, ironstone, limestone and flint	1.9	3.9
Upper Lias	Clay, stiff, blue-grey	2.1+	6.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
3	52	45	2.0-3.9	3	3	19	30	38	7	

COMPOSITION

Percentages by weight in gravel (+4 -16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
38	19	37	trace	6	trace	trace

SP 97 SE 107 **9650 7187** **Irthlingborough** **Block C**

Surface level (+34.7 m) +114 ft
Water struck at (+33.3 m)
203 mm percussion
July 1974

Overburden 1.4 m
Mineral 3.0 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.4	1.4
River Gravel (First Terrace)	Sandy gravel Gravel: fine, subangular to rounded, quartzite, flint, limestone and ironstone Sand: medium and coarse, subangular to rounded, flint, ironstone, quartz and quartzite	3.0	4.4
Upper Lias	Clay, stiff, blue-grey	1.2+	5.6

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	64	33	1.4-2.4	3	3	35	23	33	3	
			2.4-3.4	4	5	38	21	29	3	
			3.4-4.4	3	6	39	22	28	2	
			Mean	**3**	**5**	**37**	**22**	**30**	**3**	

SP 97 SE 108 **9635 7120** **Irthlingborough** **Block C**

Surface level (+34.4 m) +113 ft
Water struck at (+33.1 m)
203 mm percussion
July 1974

Overburden 1.3 m
Mineral 4.3 m
Bedrock 1.2 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	1.3	1.3
River Gravel (First Terrace)	Gravel Gravel: mainly fine, subangular, ironstone, flint, limestone and quartzite Sand: medium and coarse, rounded, flint, quartz and ironstone	4.3	5.6
Upper Lias	Clay, stiff, blue-grey	1.2+	6.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	42	55	1.3-3.3	4	3	29	27	33	4	
			3.3-4.3	2	2	9	18	50	19	
			4.3-5.6	2	2	14	23	48	11	
			Mean	**3**	**2**	**17**	**23**	**44**	**11**	

SP 97 SE 109 **9635 7037** **Stanwick** **Block C**

Surface level (+38.1 m) +125 ft
Water struck at (+33.2 m)
203 mm percussion
May 1975

Overburden 1.2 m
Mineral 1.0 m
Waste 2.7 m
Mineral 1.6 m
Bedrock 0.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Clay, medium orange-brown, sandy, with fine pebbles of limestone and sandstone	1.2	1.2
River Gravel (First Terrace)	**a** 'Very clayey' pebbly sand Gravel: fine and coarse, sandstone Sand: fine and medium with coarse, mainly quartz	1.0	2.2
	Clay, sandy, with scattered pebbles	2.6	4.8
	Clay, soft, blue-grey, silty	0.1	4.9
	b Gravel Gravel: fine with coarse, angular flint, subrounded limestone and rounded quartzite Sand: medium and coarse, quartz	1.6	6.5
Upper Lias	Clay, stiff, blue-grey	0.6+	7.1

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	$+1-4$	$+4-16$	$+16-64$	$+64$ mm
a	26	66	8	1.2-2.2	26	35	27	4	4	4	
b	7	40	53	4.9-5.5	7	6	20	14	46	7	
				5.5-6.5	No grading data available						
				Mean	**7**	**6**	**20**	**14**	**46**	**7**	
a+b	**18**	**57**	**25**	**Mean**	**18**	**23**	**26**	**8**	**20**	**5**	

SP 97 SE 111 **9745 7338** **Raunds** **Block C**

Surface level (+33.9 m) +111 ft
Water struck at (+31.3 m)
203 mm percussion
May 1975

Overburden 2.6 m
Mineral 2.2 m
Bedrock 0.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, sandy, with scattered pebbles and shell debris	2.4	2.6
River Gravel (First Terrace)	Gravel Gravel: fine with coarse, subangular, flint, ironstone, quartzite and limestone Sand: medium and coarse, quartz, flint and ironstone	2.2	4.8
Upper Lias	Clay, stiff, blue-grey	0.1+	4.9

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
1	34	65	2.6-3.5	2	1	23	24	42	8	
			3.5-4.8	1	1	11	12	51	24	
			Mean	**1**	**1**	**16**	**17**	**48**	**17**	

SP 97 SE 112 **9776 7282** **Raunds** **Block C**

Surface level (+33.5 m) +110 ft
Groundwater conditions not recorded
203 mm percussion
November 1974

Overburden 3.5 m
Mineral 1.4 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Alluvium	Clay, variegated, silty, with peat partings below 2.8 m	3.3	3.5
River Gravel (First Terrace)	Gravel Gravel: fine and coarse, angular and subangular, ironstone and limestone with quartzite and flint Sand: medium and coarse, quartz with ironstone and limestone	1.4	4.9
Upper Lias	Clay, stiff, blue-grey	0.4+	5.3

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				-1/16	+1/16 -1/4	+1/4 -1	+1 -4	+4 -16	+16 -64	+64 mm
4	28	68	3.5-4.9	4	1	11	16	39	29	

SP 97 SE 113 **9716 7231** **Stanwick** **Block C**

Surface level (+33.8 m) +111 ft
Water struck at (+32.0 m)
203 mm percussion
July 1974

Overburden 1.8 m
Mineral 3.3 m
Bedrock 0.7 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.8	0.8
Alluvium	Clay, stiff, pale blue-grey, ironstained	0.5	1.3
	Silt, soft, black, organic, containing gastropod shells and peat partings	0.5	1.8

River Gravel (First Terrace)	Gravel Gravel: mainly fine, subangular, flint, ironstone, quartzite and limestone Sand: coarse with medium, flint, quartz and ironstone	3.3	5.1
Upper Lias	Clay, stiff, blue-grey	0.7+	5.8

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
3	40	57	1.8-3.8	2	3	18	24	44	9	
			3.8-5.1	3	1	12	20	42	22	
			Mean	**3**	**2**	**16**	**22**	**43**	**14**	

SP 97 SE 114 **9716 7128** **Stanwick** **Block C**

Surface level (+35.7 m) +117 ft
Water struck at (+32.6 m)
203 mm percussion
July 1974

Overburden 0.2 m
Mineral 5.0 m
Bedrock 0.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
River Gravel (First Terrace)	'Clayey' pebbly sand Gravel: mainly fine, subangular, flint, ironstone, limestone and quartzite Sand: fine to coarse, subangular, flint, quartz and ironstone	5.0	5.2
Upper Lias	Clay, firm, blue-grey	0.9+	6.1

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
10	69	21	0.2-1.2	17	21	29	12	19	2	
			1.2-2.2	14	24	40	10	11	1	
			2.2-3.2	10	30	37	10	10	3	
			3.2-5.2	5	12	36	18	22	7	
			Mean	**10**	**20**	**36**	**13**	**17**	**4**	

SP 97 SE 115 **9805 7495** **Ringstead** **Block C**

Surface level (+33.7 m) +111 ft
Groundwater conditions not recorded
203 mm percussion
November 1974

Overburden 0.9 m
Mineral 4.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.9	0.9
River Gravel (First Terrace)	'Clayey' sandy gravel Gravel: fine with coarse, subangular, ironstone, limestone and flint Sand: fine to coarse, subangular to subrounded, quartz, limestone and ironstone	4.5+	5.4
	Hole abandoned in rising gravel		

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
12	56	32	0.9-1.9	17	24	27	15	15	2	
			1.9-2.9	19	23	28	13	15	2	
			2.9-3.9	12	21	49	6	9	3	
			3.9-4.9	3	4	14	11	35	33	
			4.9-5.4	1	5	16	16	56	6	
			Mean	**12**	**16**	**28**	**12**	**22**	**10**	

COMPOSITION

Percentages by weight in gravel (+4 -16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
37	23	37	trace	1.5	trace	1.5

SP 97 SE 116 **9886 7433** **Raunds** **Block D**

Surface level (+69.8 m) +229 ft
Water not struck
203 mm percussion
May 1974

Waste 6.4 m
Bedrock 2.5 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, brown and grey, chalky, pebbly, with sand partings	6.0	6.4
Oxford Clay	Clay, firm, blue-grey, silty, with fossils	2.5+	8.9

TL 07 NW 36 **0061 7964** **Thrapston** **Block C**

Surface level (+28.7 m) +94 ft
Water struck at (+26.4 m)
203 mm percussion
November 1974

Overburden 2.3 m
Mineral 3.7 m
Bedrock 0.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Made ground	1.4	1.4
	Clay, soft, orange-brown, pebbly	0.9	2.3
River Gravel (First Terrace)	Sandy gravel Gravel: fine and coarse, subangular to well rounded, ironstone with flint and limestone and some quartzite Sand: fine to coarse, subangular to subrounded, ironstone, quartz, limestone and flint	3.7	6.0
Upper Lias	Clay, stiff, dark blue-grey	0.4+	6.4

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
7	45	48	2.3-3.3	14	39	26	7	12	2	
			3.3-6.0	4	4	16	15	28	33	
			Mean	**7**	**13**	**19**	**13**	**24**	**24**	

COMPOSITION

Percentages by weight in gravel (+4 -16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
67	20	11	0	2	0	trace

TL 07 NW 37 **0015 7806** **Thrapston** **Block D**

Surface level (+60.9 m) +200 ft
Groundwater conditions not recorded
152 mm percussion
June 1975

Overburden 0.3 m
Mineral 1.3 m
Bedrock 1.6 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Glacial Sand and Gravel	'Very clayey' pebbly sand Gravel: fine, angular flint, rounded ironstone, limestone and quartzite Sand: fine to coarse	1.3	1.6
Oxford Clay	Clay, stiff, blue-grey	1.6+	3.2

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
38	53	9	0.3-1.6	38	14	22	17	9		

TL 07 NW 38 **0062 7659** **Denford** **Block D**

Surface level (+68.0 m) +223 ft
Water not struck
203 mm percussion
December 1974

Waste 12.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown and grey, sandy in patches, containing pebbles of chalk and flint	11.7+	12.0

TL 07 NW 39 **0127 7818** **Thrapston** **Block D**

Surface level (+67.3 m) +221 ft
Water not struck
152 mm percussion
May 1975

Overburden 9.1 m
Mineral 3.5 m
Bedrock 1.4 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Glacial Sand and Gravel	Clay, brown, very sandy, pebbly	1.5	1.7
Boulder Clay	Clay, firm, blue-grey, sandy, containing abundant chalk and pebbles of flint	7.4	9.1
Glacial Sand and Gravel	Pebbly sand Gravel: fine, subangular to subrounded, ironstone and limestone with flint and some quartz and chalk Sand: medium with fine and coarse, flint, quartz and ironstone	3.5	12.6
Oxford Clay	Clay, stiff, blue-grey, containing shell debris	1.4+	14.0

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	73	22	9.1-10.1	4	7	38	20	29	2	
			10.1-11.1	5	9	44	10	27	5	
			11.1-12.1	6	12	56	16	10		
			12.1-12.6	8	13	59	16	4		
			Mean	**5**	**10**	**48**	**15**	**20**	**2**	

COMPOSITION

Percentages by weight in gravel (+4 -16 mm) fraction

Ironstone	Flint	Limestone	Quartz	Quartzite & Sandstone	Chalk	Others
50	2	48	0	0	0	trace

TL 07 NW 40 **0362 7807** **Titchmarsh** **Block D**

Surface level (+60.1 m) +197 ft
Water not struck
203 mm percussion
December 1974

Waste 3.1 m
Bedrock 4.9 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Boulder Clay	Clay, brown, sandy, containing pebbles of chalk and flint	2.8	3.1
Oxford Clay	Clay, firm, dark grey, with sand partings and abundant shell debris	4.9+	8.0

TL 07 NW 41 **0408 7533** **Keyston** **Block D**

Surface level (+57.6 m) +189 ft
Water struck at (+52.3 m)
203 mm percussion
November 1974

Overburden 4.3 m
Mineral 6.1 m
Bedrock 2.1 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Boulder Clay	Clay, stiff, grey, containing chalk and flint pebbles	3.9	4.3
Glacial Sand and Gravel	Sandy gravel Gravel: fine, subangular to well rounded, ironstone and limestone with flint and some quartzite Sand: medium with coarse, subangular, quartz and ironstone with some limestone	6.1	10.4
Oxford Clay	Clay, dark grey, silty	2.1+	12.5

GRADING

Mean for deposit percentages			Depth below surface (m)	Percentages						
Fines	Sand	Gravel		Fines	Sand			Gravel		
				$-\frac{1}{16}$	$+\frac{1}{16}-\frac{1}{4}$	$+\frac{1}{4}-1$	+1 -4	+4 -16	+16 -64	+64 mm
5	66	29	4.3-5.3	4	7	40	22	26	1	
			5.3-6.3	2	8	47	18	25		
			6.3-7.3	2	9	54	13	20	2	
			7.3-8.3	4	11	51	12	20	2	
			8.3-9.3	3	6	31	18	39	3	
			9.3-10.4	12	6	34	12	33	3	
			Mean	**5**	**7**	**43**	**16**	**27**	**2**	

TL 07 NW 42 **0456 7969** **Titchmarsh** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 1.0 m
Bedrock 2.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.3	0.3
Alluvium	Clay, firm, yellow-brown, containing flint clasts	0.7	1.0
?Oxford Clay	Clay, dark yellow-brown, ironstained, with ?race and shell fragments	2.0+	3.0

TL 07 SW 2 **0436 7498** **Keyston** **Block D**

Surface level not recorded
Groundwater conditions not recorded
76 mm powered auger
July 1978

Waste 2.7 m
Bedrock 1.3 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.4	0.4
Alluvium	Clay, brown, sandy, with pebbles of flint and limestone, frequency increasing with depth, also belemnite fragments and shell fragments	2.3	2.7
Oxford Clay	Clay, firm, medium grey, with shell fragments	1.3+	4.0

The following reports of the Institute relate particularly to bulk mineral resources

Reports of the Institute of Geological Sciences

Assessment of British Sand and Gravel Resources

1 The sand and gravel resources of the country south-east of Norwich, Norfolk: Resource sheet TG 20.
E. F. P. Nickless.
Report 71/20 ISBN 0 11 880216 X £1.15

2 The sand and gravel resources of the country around Witham, Essex: Resource sheet TL 81. H. J. E. Haggard.
Report 72/6 ISBN 0 11 880588 6 £1.20

3 The sand and gravel resources of the country south and west of Woodbridge, Suffolk: Resource sheet TM 24.
R. Allender and S. E.Hollyer.
Report 72/9 ISBN 0 11 880596 7 £1.70

4 The sand and gravel resources of the country around Maldon, Essex: Resource sheet TL 80. J. D. Ambrose
Report 73/1 ISBN 0 11 880600 9 £1.20

5 The sand and gravel resources of the country around Hethersett, Norfolk: Resource sheet TG 10.
E. F. P. Nickless.
Report 73/4 ISBN 0 11 880606 8 £1.60

6 The sand and gravel resources of the country around Terling, Essex: Resource sheet TL 71. C. H. Eaton.
Report 73/5 ISBN 0 11 880608 4 £1.20

7 The sand and gravel resources of the country around Layer Breton and Tolleshunt D'Arcy, Essex: Resource sheet TL 91 and part 90. J. D. Ambrose.
Report 73/8 ISBN 0 11 880614 9 £1.30

8 The sand and gravel resources of the country around Shotley and Felixstowe, Suffolk: Resource sheet TM 23.
R. Allender and S. E. Hollyer.
Report 73/13 ISBN 0 11 880625 4 £1.60

9 The sand and gravel resources of the country around Attlebridge, Norfolk: Resource sheet TG 11.
E. F. P. Nickless.
Report 73/15 ISBN 0 11 880658 0 £1.85

10 The sand and gravel resources of the country west of Colchester, Essex: Resource sheet TL 92. J. D. Ambrose.
Report 74/6 ISBN 0 11 880671 8 £1.45

11 The sand and gravel resources of the country around Tattingstone, Suffolk: Resource sheet TM 13. S. E. Hollyer.
Report 74/9 ISBN 0 11 880675 0 £1.95

12 The sand and gravel resources of the country around Gerrards Cross, Buckinghamshire: Resource sheet SU 99, TQ 08, 09. H. C. Squirrell.
Report 74/14 ISBN 0 11 880710 2 £2.20

Mineral Assessment Reports

13 The sand and gravel resources of the country east of Chelmsford, Essex: Resource sheet TL 70. M. R. Clarke.
ISBN 0 11 880744 7 £3.50

14 The sand and gravel resources of the country east of Colchester, Essex: Resource sheet TM 02. J. D. Ambrose.
ISBN 0 11 880745 5 £3.25

15 The sand and gravel resources of the country around Newton on Trent, Lincolnshire: Resource sheet SK 87.
D. Price.
ISBN 0 11 880746 3 £3.00

16 The sand and gravel resources of the country around Braintree, Essex: Resource sheet TL 72. M. R. Clarke.
ISBN 0 11 880747 1 £3.50

17 The sand and gravel resources of the country around Besthorpe, Nottinghamshire: Resource sheet SK 86 and part 76. J. R. Gozzard.
ISBN 0 11 880748 X £3.00

18 The sand and gravel resources of the Thames Valley, the country around Cricklade, Wiltshire: Resource sheet SU 09, 19 and parts SP 00, 10. P R. Robson.
ISBN 0 11 880749 8 £3.00

19 The sand and gravel resources of the country south of Gainsborough, Lincolnshire: Resource sheet SK 88 and part 78. J .H. Lovell.
ISBN 0 11 880750 1 £2.50

20 The sand and gravel resources of the country east of Newark upon Trent, Nottinghamshire: Resource sheet SK 85.
J. R. Gozzard.
ISBN 0 11 880751 X £2.75

21 The sand and gravel resources of the Thames and Kennet Valleys, the country around Pangbourne, Berkshire: Resource sheet SU 67. H. C. Squirrell.
ISBN 0 11 880752 8 £3.25

22 The sand and gravel resources of the country north-west of Scunthorpe, Humberside: Resource sheet SE 81.
J. W. C. James.
ISBN 0 11 880753 6 £3.00

23 The sand and gravel resources of the Thames Valley, the country between Lechlade and Standlake: Resource sheet SP 30 and parts SP 20, SU 29, 39. P. Robson.
ISBN 0 11 881252 1 £7.25

24 The sand and gravel resources of the country around Aldermaston, Berkshire: Resource sheet SU 56, 66.
H. C. Squirrell.
ISBN 0 11 881253 X £5.00

25 The celestite resources of the area north-east of Bristol: Resource sheet ST 68 and parts 59, 69, 79, 58, 68, 78, 77.
E. F. P. Nickless, S. J. Booth and P. N. Mosley.
ISBN 0 11 881262 9 £5.00

26 The sand and gravel resources of the country around Monyash, Derbyshire: Resource sheet SK 16. F. C. Cox and D. McC. Bridge.
ISBN 0 11 881263 7 £7.00

27 The sand and gravel resources of the country west and south of Lincoln, Lincolnshire: Resource sheets SK 95 and part 96, and SK 97 and part 96. I. Jackson.
ISBN 0 11 884003 7 £6.00

28 The sand and gravel resources of the country around Eynsham, Oxfordshire: Resource sheet SP 40 and part 41.
W. J. R. Harries.
ISBN 0 11 884012 6 £3.00

29 The sand and gravel resources of the country south-west of Scunthorpe, Humberside: Resource sheet SE 80.
J. H. Lovell.
ISBN 0 11 884013 4 £3.50

30 Procedure for the assessment of limestone resources.
F. C. Cox, D. McC. Bridge and J. H. Hull.
ISBN 0 11 884030 4 £1.25

31 The sand and gravel resources of the country west of Newark upon Trent, Nottinghamshire: Resource sheet SK 75.
D. Price and P. J. Rogers.
ISBN 0 11 884031 2 £3.50

32 The sand and gravel resources of the country around Sonning and Henley, Berkshire, Oxfordshire and Buckinghamshire: Resource sheet SU 77, 78.
H. C. Squirrell.
ISBN 0 11 884032 0 £5.25

33 The sand and gravel resources of the country north of Gainsborough, Lincolnshire: Resource sheet SK 89.
J. R. Gozzard and D. Price.
ISBN 0 11 884033 9 £4.50

34 The sand and gravel resources of the Dengie Peninsula, Essex: Resource sheet TL 90 and parts 80, TM 00, TQ 89, 99, TR 09. M. B. Simmons.
ISBN 0 11 884081 9 £5.00

35 The sand and gravel resources of the country around Darvel, Strathclyde: Resource sheet comprising parts of NS 53, 54, 63, 64. E. F. P. Nickless, A. M. Aitken and A. A. McMillan.
ISBN 0 11 884082 7 £7.00

36 The sand and gravel resources of the country around Southend-on-Sea, Essex: Resource sheets comprising parts of TQ 88, 89, 98, 99, TR 08, 09; and TQ 78, 79 and parts of 88, 89. S. E. Hollyer and M. B. Simmons.
ISBN 0 11 884083 5 £7.50

37 The sand and gravel resources of the country around Bawtry, South Yorkshire: Resource sheet SK 69.
A. R. Clayton.
ISBN 0 11 884053 3 £5.75

38 The sand and gravel resources of the country around Abingdon, Oxfordshire: Resource sheet SU 49, 59, SP 40, 50.
C. E. Corser.
ISBN 0 11 884084 5 £5.50

39 The sand and gravel resources of the Blackwater Valley (Aldershot) area: Resource sheet SU 85, 86 and parts 84, 94, 95, 96. M. R. Clarke, A. J. Dixon and M. Kubala.
ISBN 0 11 884085 1 £7.00

40 The sand and gravel resources of the country west of Darlington, County Durham: Resource sheet NZ 11, 21.
A. Smith.
ISBN 0 11 884086 X £5.00

41 The sand and gravel resources of the country around Garmouth, Grampian Region: Resource sheet NJ 36.
A. M. Aitken, J. W. Merritt and A. J. Shaw.
ISBN 0 11 884090 8 £8.75

42 The sand and gravel resources of the country around Maidenhead and Marlow: Resource sheet SU 88 and parts 87, 97, 98. P. N. Dunkley.
ISBN 0 11 884091 6 £5.00

43 The sand and gravel resources of the country around Misterton, Nottinghamshire: Resource sheet SK 79.
D. Thomas and D. Price.
ISBN 0 11 884092 4 £5.25

44 The sand and gravel resources of the country around Sedgefield, Durham: Resource sheet NZ 32. M. D. A. Samuel.
ISBN 0 11 884093 2 £5.75

45 The sand and gravel resources of the country around Brampton, Cumbria: Resource sheet NY 55, part 56. I. Jackson.
ISBN 0 11 884094 0 £6.75

46 The sand and gravel resources of the country north of Harlow, Essex: Resource sheet TL 41. P. M. Hopson.
ISBN 0 11 884107 6 £9.50

47 The limestone and dolomite resources of the country around Wirksworth, Derbyshire: Resource sheet SK 25 and part 35. F. C. Cox and D. J. Harrison.
ISBN 0 11 884108 4 £15.00

48 The sand and gravel resources of the Loddon Valley area: Resource sheet SU 75, 76, and parts 64, 65, 66, 74.
M. R. Clarke, E. J. Raynor and R. A. Sobey.
ISBN 0 11 884109 2 £8.75

49 The sand and gravel resources of the country around Lanark, Strathclyde Region: Resource sheet NS 94 and part 84. J. L. Laxton and E. F. P. Nickless.
ISBN 0 11 884110 6 £11.00

50 The sand and gravel resources of the country around Fordingbridge, Hampshire: Resource sheet SU 11 and parts 00, 01, 10, 20, 21. M. Kubala.
ISBN 0 11 884111 4 £7.75

51 The sand and gravel resources of the country north of Bournemouth, Dorset: Resource sheet SU 00, 10, 20, SZ 09, 19, 29. M. R. Clarke.
ISBN 0 11 884112 2 £9.75

52 The sand and gravel resources of the country between Hatfield Heath and Great Waltham, Essex: Resource sheet TL 51, 61. R. J. Marks.
ISBN 0 11 884113 0 £8.00

53 The sand and gravel resources of the country around Cottenham, Cambridgeshire: Resource sheet TL 46, 47.
A. J. Dixon.
ISBN 0 11 884114 9 £9.25

54 The sand and gravel resources of the country around Huntingdon and St Ives, Cambridgeshire: Resource sheets comprising parts of TL 16, 17, 26, 27; and TL 26, 27, 36, 37.
R. W. Gatliff.
ISBN 0 11 884115 7 £8.75

55 The sand and gravel resources of the country around Ipswich, Suffolk: Resource sheet TM 14. R. Allender and S. E. Hollyer.
ISBN 0 11 884116 5 £10.00

56 Procedure for the assessment of the conglomerate resources of the Sherwood Sandstone Group. D. P. Piper and P. J. Rogers.
ISBN 0 11 884143 2 £1.25

57 The conglomerate resources of the Sherwood Sandstone Group of the country around Cheadle, Staffordshire: Resource sheet SK 04. P. J. Rogers, D. P. Piper and T. J. Charsley.
ISBN 0 11 884144 0 £7.75

58 The sand and gravel resources of the country west of Peterhead, Grampian Region: Resource sheet NK 04 and parts NK 05, 14, 15, NJ 94, 95. A. A. McMillan and A. M. Aitken.
ISBN 0 11 884145 9 £12.00

59 The sand and gravel resources of the country around Newbury, Berkshire: Resource sheet SU 46, 47 and parts 36, 37, 47. J. R. Gozzard.
ISBN 0 11 884146 7 £11.50

60 The sand and gravel resources of the country south-west of Peterborough, in Cambridgeshire and east Northamptonshire: Resource sheets TL 09, 19 and SP 98, TL 08.
A. M. Harrisson.
ISBN 0 11 884147 5 £15.50

61 The sand and gravel resources of the country north of Wrexham, Clwyd: Resource sheet SJ 35 and part 25.
P. N. Dunkley.
ISBN 0 11 884148 3 £11.75

62 The sand and gravel resources of the country around Dolphinton, Strathclyde Region, and West Linton, Borders Region: Resource sheet NT 04, 14 and parts 05 15.
A. A. McMillan, J. L. Laxton and A. J. Shaw.
ISBN 0 11 884149 1 £8.00

63 The sand and gravel resources of the valley of the Douglas Water, Strathclyde Region: Resource sheet NS 83 and parts 82, 92, 93. A. J. Shaw and E. F. P. Nickless.
ISBN 0 11 884150 5 £11.50

64 The sand and gravel resources of the country between Wallingford and Goring, Oxfordshire: Resource sheet SU 68 and part 58. C. E. Corser.
ISBN 0 11 884151 3 £11.50

65 The sand and gravel resources of the country around Hexham, Northumberland: Resource sheet NY 86, 96.
J. H. Lovell.
ISBN 0 11 884152 1 £7.50

66 The sand and gravel resources of the country west of Chelmsford, Essex: Resource sheet TL 60. P. M. Hopson.
ISBN 0 11 884153 X £8.50

67 The sand and gravel resources of the country around Hatfield and Cheshunt, Hertfordshire: Resource sheet TL 20, 30 and parts TQ 29, 39. J. R. Gozzard.
ISBN 0 11 884167 X £10.00

68 The sand and gravel resources of the country north-east of Halstead, Essex: Resource sheet TL 83. R. J. Marks and J. W. Merritt.
ISBN 0 11 884168 8 £13.25

69 The sand and gravel resources of the country around Welwyn Garden City, Hertfordshire: Resource sheet TL 11, 21.
J. R. Gozzard.
ISBN 0 11 884169 6 £10.50

70 The sand and gravel resources of the country east of Harrogate, North Yorkshire: Resource sheet SE 35.
D. L. Dundas.
ISBN 0 11 884170 7 £15.50

71 The sand and gravel resources of the country around Hemel Hempstead, St Albans and Watford: Resource sheet TL 00, 10, and parts TQ 09, 19.
W. J. R. Harries, S. E. Hollyer and P. M. Hopson.
ISBN 0 11 884171 8 £12.00

72 The sand and gravel resources of the country around Bury St Edmunds, Suffolk: Resource sheet TL 86.
M. P. Hawkins.
ISBN 0 11 884172 6 £10.50

73 The sand and gravel resources of the country between Ely and Cambridge, Cambridgeshire: Resource sheet TL 56, 57. A. R. Clayton.
ISBN 0 11 884173 4 £9.50

74 The sand and gravel resources of the country around Blaydon, Tyne and Wear: Resource sheet NZ 06, 16.
J. R. A. Giles.
ISBN 0 11 884174 2 £10.50

75 The sand and gravel resources of the country around Stokesley, North Yorkshire: Resource sheet NZ 40, 50, and parts 41, 51. R. G. Crofts.
ISBN 0 11 884175 0 £11.50

76 The sand and gravel resources of the country around Ellon, Grampian Region: Resource sheets NJ 93 with parts 82, 83, 92, and NK 03 with parts 02, 13. J. W. Merritt.
ISBN 0 11 884176 9 £15.00

77 The limestone and dolomite resources of the country around Buxton, Derbyshire: Resource sheet SK 07 and parts 06, 08. D. J. Harrison.
ISBN 0 11 884177 7 £13.50

78 The sand and gravel resources of the country west of Boroughbridge, North Yorkshire: Resource sheet SE 36.
D. A. Abraham.
ISBN 0 11 884178 5 £12.75

79 The limestone and dolomite resources of the country around Bakewell, Derbyshire: Resource sheet SK 26 and part 27. D. McC. Bridge and J. R. Gozzard.
ISBN 0 11 884179 3 £10.50

80 The sand and gravel resources of the country between Stamford, Lincolnshire, and Peterborough, Cambridgeshire: Resource sheet TF 00, 10. S. J. Booth.
ISBN 0 11 884180 7 £14.50

81 The sand and gravel resources of the country around Dorchester and Watlington, Oxfordshire: Resource sheet SU 69 and part 59. C. E. Corser.
ISBN 0 11 884204 8 £14.25

82 The sand and gravel resources of the country around Sible Hedingham, Essex: Resource sheet TL 73.
R. J. Marks and D. W. Murray.
ISBN 0 11 884205 6 £10.75

83 The sand and gravel resources of the country around Hollesley, Suffolk: Resource sheet TM 34.
S. E. Hollyer and R. Allender.
ISBN 0 11 884206 4 £13.25

84 The sand and gravel resources of the country around Kirk Hammerton, North Yorkshire: Resource sheet SE 45.
J. R. A. Giles.
ISBN 0 11 884207 2 £10.00

85 The sand and gravel resources of the country around Nayland, Suffolk: Resource sheet TL 93. P. M. Hopson.
ISBN 0 11 884208 0 £11.25

86 The sand and gravel resources of the country around Wem, Shropshire: Resource sheet SJ 42, 52.
B. Cannell and W. J. R. Harries.
ISBN 0 11 884209 9 £15.50

87 The sand and gravel resources of the country around Ranskill and East Retford, Nottinghamshire: Resource sheet SK 68 and part 78. D. Thomas.
ISBN 0 11 884210 2 £8.50

88 The sand and gravel resources of the country around Tholthorpe, North Yorkshire: Resource sheet SE 46.
R. Stanczyszyn.
ISBN 0 11 884211 0 £13.00

89 The sand and gravel resources of the country around Newport-on-Tay, Fife Region: Resource sheet NO 42 and parts 32, 52. J. L. Laxton and D. L. Ross.
ISBN 0 11 887413 6 £12.75

90 The sand and gravel resources of the country around Shrewsbury, Shropshire: Resource sheet SJ 41, 51.
B. Cannell.
ISBN 0 11 884213 7 £17.00

91 The conglomerate resources of the Sherwood Sandstone Group of the country east of Stoke-on-Trent, Staffordshire: Resource sheet SJ 94. D. Piper.
ISBN 0 11 884214 5 £7.00

92 The sand and gravel resources of the country around Armthorpe, South Yorkshire: Resource sheet SE 60. D. Price and D. P. Best.
ISBN 0 11 884215 3 £10.00

93 The sand and gravel resources of the country around Whittlesey, Cambridgeshire: Resource sheet TF 20, TL 29.
S. J. Booth.
ISBN 0 11 884216 1 £12.50

94 The sand and gravel resources of the country north and west of Woodhall Spa, Lincolnshire: Resource sheet TF 16 and part 17. I. Jackson.
ISBN 0 11 884217 X £14.75

95 The sand and gravel resources of the country around Biggar, Strathclyde Region: Resource sheet NS 93, NT 03, and parts NS 92, NT 02. A. J. Shaw and J. W. Merritt.
ISBN 0 11 887414 4 £15.00

96 The sand and gravel resources of the country around Potter Hanworth and Reepham, Lincolnshire: Resource sheet TF 06, 07. R. G. Crofts.
ISBN 0 11 884219 6 £9.75

97 The sand and gravel resources of the country around Clare, Suffolk: Resource sheet TL 74. R. Marks.
ISBN 0 11 884297 8 £10.00

98 The limestone and dolomite resources of the country around Tideswell, Derbyshire: Resource sheet SK 17 and parts 18, 27. R. W. Gatliff.
ISBN 0 11 884298 6 £14.50

99 The sand and gravel resources of the country north and west of Billingham, Cleveland: Resource sheet NZ 42 and part 52. J. W. C. James.
ISBN 0 11 884299 4 £10.50

100 The sand and gravel resources of the country around Billinghay, Lincolnshire: Resource sheet TF 15 and part 05.
J. B. L. Wild.
ISBN 0 11 884300 1 £13.75

101 The sand and gravel resources of the country around Glenrothes, Fife Region: Resource sheet NO 20 and parts 21, 30, 31. A. M. Aitken and D. L. Ross.
ISBN 0 11 887415 2 £15.00

102 The sand and gravel resources of the country around Coggeshall, Essex: Resource sheet TL 82. S. J. Booth and J. W. Merritt.
ISBN 0 11 887416 0 £16.00

103 The sand and gravel resources of the country between Dorchester and Wareham, Dorset: Resource sheets comprising parts of SY 68, 69, 78, 79, 88, 89, 98, 99.
S. J. Mathers.
ISBN 0 11 884303 6 £17.00

104 The sand and gravel resources of the country around Stansted Mountfitchet, Essex: Resource sheet TL 52.
P. M. Hopson.
ISBN 0 11 884304 4 £11.75

105 The sand and gravel resources of the Welshampton area, Shropshire and Clwyd: Resource sheet SJ 43. Institute of Geological Sciences.
ISBN 0 11 884305 2 £12.00

106 The sand and gravel resources of the country south of Wrexham, Clwyd: Resource sheet SJ 34 and part 24. D. F. Ball.
ISBN 0 11 884306 0 £11.00

107 The sand and gravel resources of the country between Rugby and Northampton, Warwickshire and Northamptonshire: Resource sheet SP 66 and parts 56, 57, 65, 67, 75 and 76. M. R. Clarke and E. R. Moczarski.
ISBN 0 11 884307 9 £20.00

108 The sand and gravel resources of the country south of Horncastle, Lincolnshire: Resource sheet TF 26. G. Power and J. B. L. Wild.
ISBN 0 11 884308 7 £9.75

109 The sand and gravel resources of the country around Great Dunmow, Essex: Resource sheet TL 62. C. W. Thomas.
ISBN 0 11 884309 5 £12.75

110 The sand and gravel resources of the country north of Newmarket, Cambridgeshire and Suffolk: Resource sheet TL 67 and part 66. C. E. Corser.
ISBN 0 11 884310 9 £14.50

111 The sand and gravel resources of the country east and south-east of Darlington, Durham: Resource sheet NZ 30, 31. J. R. Gozzard and D. Price.
ISBN 0 11 884311 7 £14.25

112 The sand and gravel resources of the country around Hertford, Hertfordshire: Resource sheet TL 31. P. M. Hopson and M. D. A. Samuel.
ISBN 0 11 884312 5 £11.75

113 The sand and gravel resources of the country around Mold, Clwyd: Resource sheet SJ 26 and part 16. D. F. Ball and K. A. McL. Adlam.
ISBN 0 11 884313 3 £12.00

114 The sand and gravel resources of the country around Kettering and Wellingborough, in parts of Northamptonshire, Cambridgeshire and Bedfordshire: Resource sheets SP 97 and parts SP 87, TL 07; and SP 86, 96. A. M. Harrisson.
ISBN 0 11 884314 1 £18.00

115 The sand and gravel resources of the country east of Solihull, Warwickshire: Resource sheet comprising parts of SP 17, 18, 27, 28. B. Cannell.
ISBN 0 11 884315 X £10.75

116 The limestone resources of the Craven Lowlands: Resource sheet comprising parts of 1:50000 geological sheets 59, 69, 61, 67, 68 and 69. D. J. Harrison.
ISBN 0 11 884316 8 £15.00

117 The sand and gravel resources of the country around Redgrave, Suffolk: Resource sheet TM 07 and part 08. C. A. Auton.
ISBN 0 11 884317 6 £15.00

118 The sand and gravel resources of the country around Sudbury, Suffolk: Resource sheet TL 84. P. M. Hopson.
ISBN 0 11 884318 4 £12.50

119 The sand and gravel resources of the country around Bedale, North Yorkshire: Resource sheet SE 28. J. R. A. Giles.
ISBN 0 11 884319 2 £11.75

120 The sand and gravel resources of the country around Catterick, North Yorkshire: Resource sheet SE 29. J. H. Lovell.
ISBN 0 11 884320 6 £10.75

121 The sand and gravel resources of the country around Callander and Dunblane, Central Region: Resource sheet NN 60, 70. J. W. Merritt and J. L. Laxton.
ISBN 0 11 887417 9 £15.00

Reports of the Institute of Geological Sciences

Other Reports

69/9 Sand and gravel resources of the Inner Moray Firth. A. L. Harris and J. D. Peacock.
ISBN 0 11 880106 6 35p

70/4 Sands and gravels of the southern counties of Scotland. G. A. Goodlet.
ISBN 0 11 880105 8 90p

72/8 The use and resources of moulding sand in Northern Ireland. R. A. Old.
ISBN 0 11 881594 0 30p

73/9 The superficial deposits of the Firth of Clyde and its sea lochs. C. E. Deegan, R. Kirby, I. Rae and R. Floyd.
ISBN 0 11 880617 3 95p

77/1 Sources of aggregate in Northern Ireland (2nd edition). I. B. Cameron.
ISBN 0 11 881279 3 70p

77/2 Sand and gravel resources of the Grampian Region. J. D. Peacock and others.
ISBN 0 11 881282 3 80p

77/5 Sand and gravel resources of the Fife Region. M. A. E. Browne.
ISBN 0 11 884004 5 60p

77/6 Sand and gravel resources of the Tayside Region. I. B. Paterson.
ISBN 0 11 884008 8 £1.40

77/8 Sand and gravel resources of the Strathclyde Region. I. B. Cameron and others.
ISBN 0 11 884028 2 £2.50

77/9 Sand and gravel resources of the Central Region, Scotland. M. A. E. Browne.
ISBN 0 11 884016 9 £1.35

77/19 Sand and gravel resources of the Borders Region, Scotland. A. D. McAdam.
ISBN 0 11 884025 8 £1.00

77/22 Sand and gravel resources of the Dumfries and Galloway Region of Scotland. I. B. Cameron.
ISBN 0 11 884021 5 £1.20

78/1 Sand and gravels of the Lothian Region of Scotland. A. D. McAdam.
ISBN 0 11 884042 8 £1.00

78/8 Sand and gravel resources of the Highland Region. W. Mykura, D. L. Ross and F. May.
ISBN 0 11 884050 9 £3.00

Dd 717414 C10

Printed in England for Her Majesty's Stationery Office by Commercial Colour Press, London E7

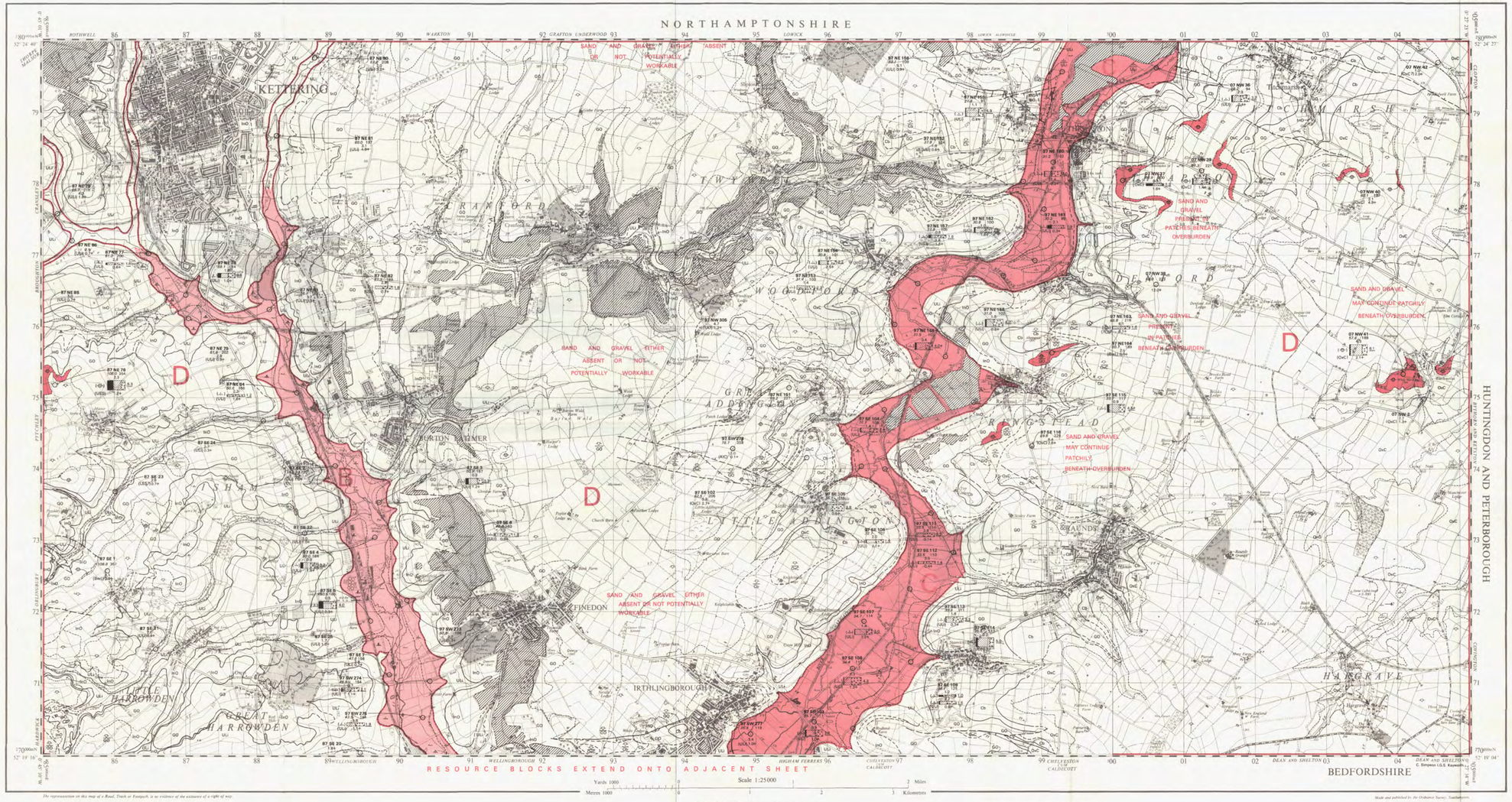
INSTITUTE OF GEOLOGICAL SCIENCES

INDUSTRIAL MINERALS ASSESSMENT UNIT

THE SAND AND GRAVEL RESOURCES OF THE COUNTRY AROUND KETTERING AND WELLINGBOROUGH, NORTHANTS. SHEET 1

Scale 1:25 000 or about 2½ Inches to 1 Mile

ORDNANCE SURVEY
SHEET SP97 & PARTS OF SP87 & TL07
PROVISIONAL EDITION



Yards 1000 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Scale 1:25000

The representation on this map of a Road, Track or Footpath, is no evidence of the existence of a right of way.

Solid Geological Survey by G.W. Green, S.E. Hollingworth, J.E. Prentice, J.H. Taylor and V. Wilson in 1960-1961. T.N. Whitehead and H.G. Dines, District Geologists.
Included in One-inch New Series Geological Sheets 171 and 186.
Worked-out sand and gravel areas shown to 1975. Worked-out ironstone areas shown to 1960.
Sand and Gravel Survey by A.N.Fawcett, A.M.Harrison, J.W.Merritt and J.&.L.Wild in 1974-1978.
K.G.Thorne, Head, Industrial Minerals Assessment Unit.
Sand and Gravel Resources Sheet published 1983.
G.M.Brown, D.Sc., F.R.S., Director, Institute of Geological Sciences.
1100-83

The GRID Lines on this sheet are at 1 Kilometre interval.
Heights are in feet above Mean Sea Level at Newlyn.
Contour values are in feet.
1 square inch on this map represents 96·8 acres on the ground.

Data quoted for an individual borehole refer strictly to that site; reliable correlations cannot be drawn about the thickness and grading elsewhere in the deposit, particularly in material as variable as sand and gravel. However, estimates of the volume and mean grading of the mineral as a whole in each Resource Block are given in the Report.

Compiled from 6" sheets last fully revised 1899-1924.
Other partial systematic revision 1938-50 has been incorporated.
Major roads revised 1969.

Made and published by the Ordnance Survey, Southampton.

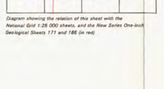


Diagram showing the relation of this sheet with the National Grid 1:25 000 sheets, and the New Series One-inch Geological Sheets 171 and 186 (in red).

THE SAND AND GRAVEL RESOURCES OF THE COUNTRY AROUND KETTERING AND WELLINGBOROUGH, NORTHANTS. SHEET 1
SHEET SP 97 AND PARTS OF SP 87 & TL 07

114 (SHEET 1)

This map should be read in conjunction with the accompanying Report which contains details of the assessment of resources.

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

DRIFT

—	**Alluvium** — mainly clay	A-68
▲	**Alluvial Fan** — clay, sand and gravel	AF-6
⊥	**First Terrace** — gravels and sands of the Nene and its tributaries	1T-23
⊥	**Second Terrace** — gravels and sands of the Nene and its tributaries	2T-16
⁂	**Calcareous Tufa** — hard limestone precipitate	CT-4
○	**Boulder Clay** — grey, brown - weathering clay with pebbles	BC-43
◈	**Glacial Sand and Gravel** — sands and gravels	GS-33

Holocene / Pleistocene — QUATERNARY

SOLID

OxC	**Oxford Clay** — incorporating **Kellaways Clay** (KC) and **Kellaways Sand** (KS)
Cb	**Cornbrash** — hard shelly limestone
GO	**Great Oolite Group** — incorporating **Blisworth Clay** (BxC), **Blisworth Limestone** (BxL) and **Upper Estuarine 'Series'** (UES)
lnO	**Inferior Oolite Group** — incorporating **Lower Estuarine 'Series'** (LES) and **Northampton Sand** Ironstone (NSI)
UU	**Upper Lias (undivided)** — fissile mudstones weathering to a blue-grey clay
▨	Worked-out ground (sand and gravel, limestone, ironstone) WO-23

JURASSIC

BOUNDARY LINES

- Geological boundary, Drift
- Geological boundary, Solid
- Fault, crossmark indicates downthrow side
- Inferred boundary between recognised categories of deposits
- Resource Block boundary

Broken lines denote uncertainty

BOREHOLE DATA

SITE LOCATIONS

○ Industrial Minerals Assessment Unit (I.M.A.U.) Boreholes

I.M.A.U. BOREHOLES

Borehole Registration Number — 97 SE 109
Borehole Site — 38.1 125+ — Surface level in metres and feet above O.D. (Newlyn)
Strata — 1.2+ Overburden; 1.8+ Mineral (sand and gravel)
Geological Classification — 0.6+ Bedrock
Grading Diagram
Thicknesses in metres

Note:
(i) Figures underlined denote thicknesses used in the assessment of resources.
(ii) The + sign indicates that the base of the deposit was not reached.
(iii) The figures in italics are the conversions to metres of the measurements recorded in feet.
(iv) The Geological Classification is given only for mineral and bedrock.

Borehole Registration Number
Each I.M.A.U. borehole is identified by a Registration Number, for example 97 SE 109.
The first number and letters refer to the quarter sheet, and the figures to the O.S. serial numbers for that quarter. The unique designation for borehole 97 SE 109 is SP 97 SE 109.

Grading Diagrams
Each grading diagram shows the mean particle size distribution of a distinct deposit of mineral.

Sand (1/16–4 mm) — Fines (– 1/16 mm) — Gravel (– 4 mm)

The height of the diagram is proportional to the mineral thickness.
The widths of the divisions show the proportions of **Fines**, **Sand** and **Gravel**.

CATEGORIES OF DEPOSITS

Exposed mineral	CAT-E6
Continuous or almost continuous spreads of mineral beneath overburden	CAT-C1
Discontinuous spreads of mineral beneath overburden	CAT-D1
Sand and gravel not potentially workable (see Report), not assessed or absent	CAT-A2

RESOURCE BLOCKS
For the purpose of assessment, the mineral-bearing land is divided into Resource Blocks (see Report). Each is designated by a letter

Any enquiries concerning this map may be addressed to Head, Industrial Minerals Assessment Unit, Institute of Geological Sciences, Keyworth, Nottingham NG12 5GG.

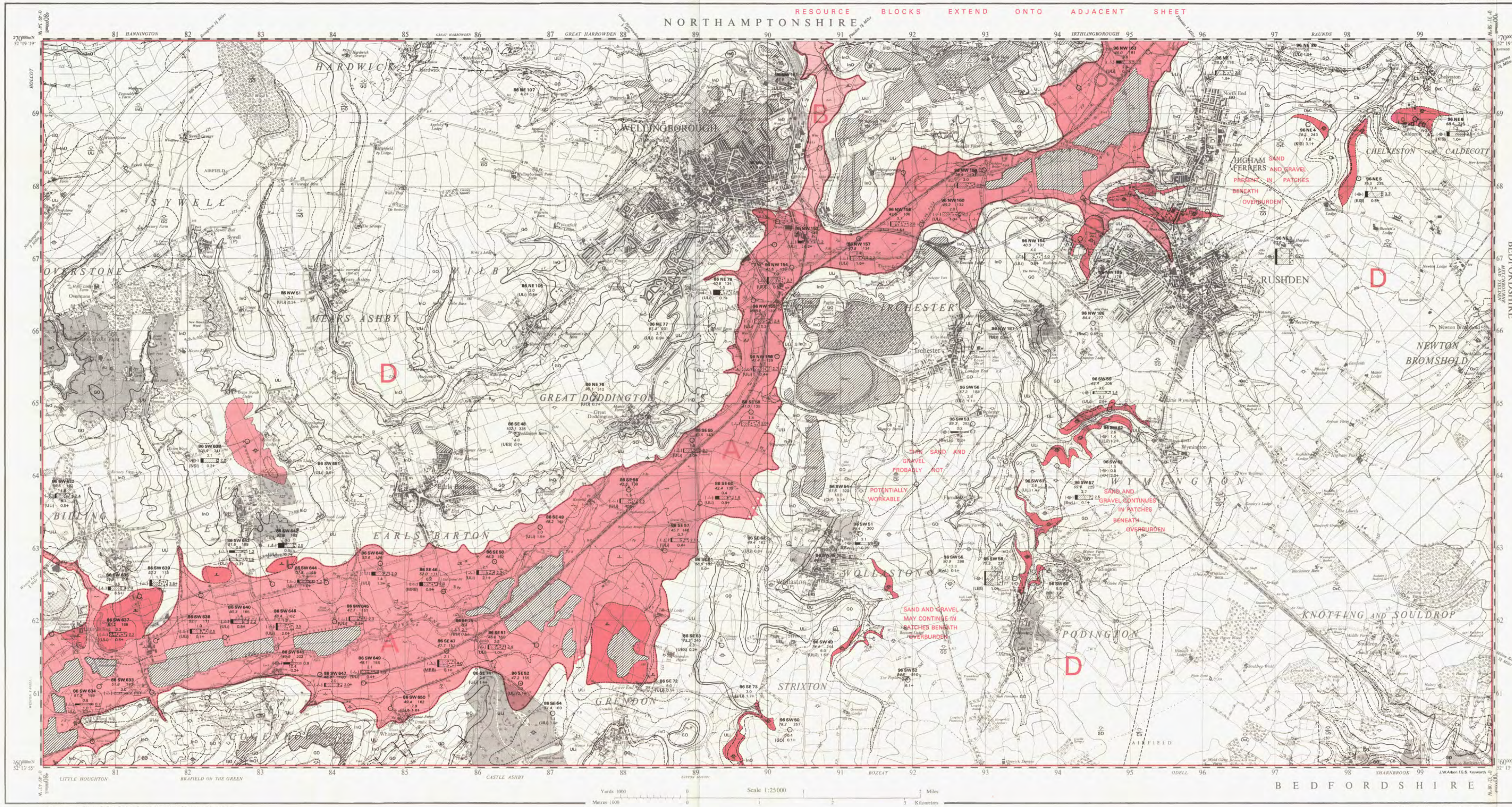
INSTITUTE OF GEOLOGICAL SCIENCES

INDUSTRIAL MINERALS ASSESSMENT UNIT

THE SAND AND GRAVEL RESOURCES OF THE COUNTRY AROUND KETTERING AND WELLINGBOROUGH, NORTHANTS. SHEET 2

Scale 1:25 000 or about 2½ Inches to 1 Mile

ORDNANCE SURVEY
SHEET SP86 & SP96
PROVISIONAL EDITION



The representation on this map of a Road, Track, or Footpath, is no evidence of the existence of a right of way.

Original One-inch Geological Survey (parts only) in 1887-1898.

Six-inch Geological Survey by W.B.Evans, G.W.Green, S.E.Hollingworth, V.Wilson and A.W.Woodland in 1939-1947. T.H.Whitehead and H.G.Dines, District Geologists.

Included in One-inch New Series Geological Sheets 185 and 186.

Worked-out sand and gravel areas shown to 1975. Worked-out ironstone areas shown to 1961.

Sand and Gravel Survey by A.H.Fawcett, A.M.Harrisson, J.W.Merritt and J.B.L.Wild in 1974-1978. R.G.Thurrell, Head, Industrial Minerals Assessment Unit.

1:25 000 Sand and Gravel Resource Sheet published 1983.

G.M.Brown, D.Sc., F.R.S., Director, Institute of Geological Sciences.

1100/83

The GRID Lines on this sheet are at 1 Kilometre interval.
Heights are in feet above Mean Sea Level at Newlyn.
Contour values are in feet.
1 square inch on this map represents 96·639 acres on the ground.

Data quoted for an individual borehole refer strictly to that site; reliable conclusions cannot be drawn about the thickness and grading elsewhere in the deposit, particularly in material as variable as sand and gravel. However, estimates of the volume and mean grading of the mineral as a whole in each Resource Block are given in the Report.

Compiled from 6" sheets last fully revised 1899-1924.
Other partial systematic revision 1938-50 has been incorporated.

Made and published by the Ordnance Survey, Southampton.

Diagram showing the relation of this sheet with the National Grid 1:25 000 sheets, and the New Series One-Inch Geological Sheets 185 and 186 (in red)

THE SAND AND GRAVEL RESOURCES OF THE COUNTRY AROUND KETTERING AND WELLINGBOROUGH, NORTHANTS. SHEET 2 SHEET SP 86 & SP 96.

This map should be read in conjunction with the accompanying Report which contains details of the assessment of resources.

EXPLANATION OF SYMBOLS AND ABBREVIATIONS

114 (SHEET 2)

DRIFT

- **Alluvium** — mainly clay A-68 (Holocene)
- **Alluvial Fan** — clay, sand and gravel AF-6 (Holocene)
- **First Terrace** — gravels and sands of the Nene and its tributaries 1T-23
- **Second Terrace** — gravels and sands of the Nene and its tributaries 2T-16
- **Calcareous Tufa** — hard limestone precipitate CT-4
- **Head** H-12
- **Boulder Clay** — grey, brown-weathering clay with pebbles BC-43
- **Glacial Sand and Gravel** — sands and gravels GS-33

(Pleistocene; QUATERNARY)

SOLID

- OxC — **Oxford Clay** — incorporating **Kellaways Clay** (KlC) and **Kellaways Sand** (KlS)
- Cb — **Cornbrash** — hard shelly limestone
- GO — **Great Oolite Group** — incorporating **Blisworth Clay** (BwC), **Blisworth Limestone** (BwL) and **Upper Estuarine 'Series'** (UES)
- InO — **Inferior Oolite Group** — incorporating **Lower Estuarine 'Series'** (LES) and **Northampton Sand Ironstone** (NSI)
- ULi — **Upper Lias, (undivided)** — fissile mudstones weathering to a blue-grey clay
- MLi — **Middle Lias** — not shown seperately from Upper Lias on map. Incorporating **Marlstone Rock Bed** (MRB) — proved in boreholes

(JURASSIC)

Worked-out ground (sand and gravel, limestone, ironstone) WO-23

BOUNDARY LINES

- Geological boundary, Drift
- Geological boundary, Solid
- Fault at surface, crossmark indicates downthrow side

Broken lines denote uncertainty

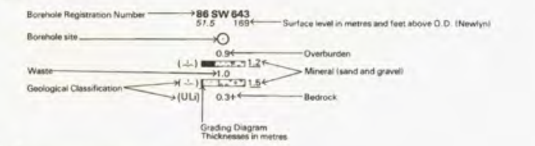
- Inferred boundary between recognised categories of deposits
- Resource Block boundary

BOREHOLE DATA

SITE LOCATIONS

- Industrial Minerals Assessment Unit (I.M.A.U.) Boreholes
- Other boreholes

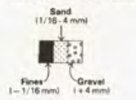
I.M.A.U. BOREHOLES



Note:
(i) Figures underlined denote thicknesses used in the assessment of resources
(ii) The + sign indicates that the base of the deposit was not reached
(iii) The figures in italics are the conversions to metres of the measurements recorded in feet.
(iv) The Geological Classification is given only for mineral and bedrock.

Borehole Registration Number
Each I.M.A.U. borehole is identified by a registration number e.g. 86 SW 643. The first number and letters refer to the quarter sheet, and the second number to the I.G.S. serial number for that quarter. The unique designation for borehole 86 SW 643 is SP 86 SW 643.

Grading Diagrams
Each grading diagram shows the mean particle size distribution of a distinct deposit of mineral.



The height of the diagram is proportional to the mineral thickness. The widths of the divisions show the proportions of **Fines, Sand** and **Gravel**

OTHER BOREHOLES
The layout of information is the same as for I.M.A.U. boreholes, although data available may not be as comprehensive. They are registered in the same series as I.M.A.U. boreholes.

CATEGORIES OF DEPOSITS

- **Exposed mineral** CAT-E6
- **Continuous or almost continuous spreads of mineral beneath overburden** CAT-C1
- **Discontinuous spreads of mineral beneath overburden** CAT-D1
- **Sand and gravel not potentially workable (see Report), not assessed or absent** CAT-A2

RESOURCE BLOCKS
For the purpose of assessment, the mineral-bearing land is divided into Resource Blocks (see Report). Each is designated by a letter.

Any enquiries concerning this map may be addressed to Head, Industrial Minerals Assessment Unit, Institute of Geological Sciences, Keyworth, Nottingham NG12 5GG.